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October 1992

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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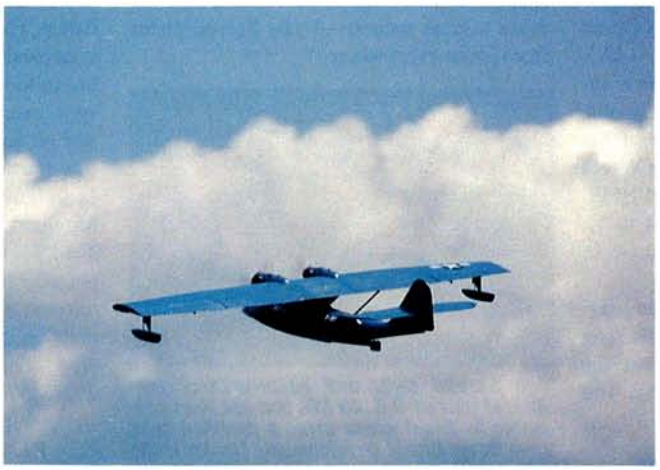
OCTOBER 1992 VOLUME 120, NUMBER 10

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE



ABOVE: *the G&P Sales PBY takes to the skies (see review this issue; photo by Walter Sidas).*

ON THE COVER: *the Ace R/C Big Bingo shows off its gentle handling characteristics. (Photo by Rich Uravitch.) Inset: at this year's Clearlake meet, Bill Price of G&P Sales syncs the twin .60s on his latest kit offering—a 10-foot version of the PBY Catalina. (Photo by John Sullivan.)*

FEATURES

HELICOPTER SECTION

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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EDITORIAL

TOM ATWOOD

MUNCIE OPENS, '92 NATS, OTHER NEWS

Our correspondent Mike Shaw reported that the June 13 to 14 Muncie Grand Opening was a propitious start for the AMA's most ambitious project to date. Muncie is approximately 60 miles north of Indianapolis, and if you are going there for one of the events planned for this summer (Scale World Championships, August 22 to 29, and NFFS 4A Free Flight contest, September 4 to 7), you are advised to make room reservations in Muncie well in advance.

Mike reports: "The turnout was impressive. One L-shaped flight line, three parking lots and a pavilion had been built at the Muncie site as of the official opening. The flight-line was set up with six pilot positions at all times, and the air space was always alive with numerous types of aircraft. Over 1,000 flight-line badges were issued, and on Saturday, the busiest day, 388 flights took place. If there was one minor disappointment for a few of the pilots, it was that this first flying site did not have a spacious, grass-covered area between the crowds and the asphalt runway that could accommodate large pit-area tents. Multiple flying areas are planned at Muncie, and perhaps others designated for fun-flys will include larger pit areas along the flight line.

"Also completed at the site was a 25,000-square-foot administration building to house offices, the AMA museum, library and souvenir shop. However, it will be about a year before the museum and shop will be completed. A reception was held at the museum on Friday the 12th, and boxes of memorabilia of all sorts could be seen, along with a display of patches for every sanctioned flying club across the U.S. A primitive campground area was ready for visitors, and it is expected that it will be upgraded with various facilities in the next few years.

"The master plan for the development of Muncie includes several flight lines for a variety of aircraft, including pylon racers, free flight, pattern ships, helicopters and others. In addition, two off-road car tracks and a 100x500-foot boat pond are planned.

"At the opening, a 60x80-foot tent housed the exhibitors' display area, which included a swap shop. The heat and dry weather helped maintain long lines for refreshments. All types of airplanes flew, from giant scale to sport craft to ducted fans. I would call the event a great success—I saw license plates from about everywhere."

Bob Shapiro (left) and Editor-in-Chief Tom Atwood start an O.S. 40 SFR that has been converted to diesel power using a modified head from Davis Diesel Development. The kit is the new Sig Midstar 40, which will be reviewed in an upcoming issue.

'92 AMA NATS

On June 20 to 29, the AMA National Championships was held at Westover Air Force base in Massachusetts for the third time. Although rain interrupted the schedule from time to time, the event was by all accounts a big success. Because of its size, Westover easily accommodates a large scale event, but "attendees" also reported it offered some perspectives that stirred the imagination. Where else could you watch micro-light, indoor, free-flight airplanes slowly crawl through the air, and then, just outside the hangar, behold a giant C-5A Galaxy sitting in majestic repose.

We are happy to note that two of our columnists did well at the Nats. Michael Lachowski, who authors "Center on Lift" (this issue, he addresses obechi sheeting in a feature article), placed 5th in Standard Sailplane, 4th in Unlimited Sailplane, 6th in F3B Sailplane and 1st in F3E Sailplane (electric). Dave Patrick, author of "Aerobatics Made Easy," placed 6th in F3A Aerobatics. For those who watch pattern competition, the names ranking above Dave were familiar ones: 1st, David Von Linsowe; 2nd, Bill Cunningham; 3rd, Chip Hyde; 4th, Steve Stricker; and 5th, Stephen Rojecki.

NEW GIANT SCALE AIR RACING ASSOCIATION

The first meeting of the Giant Scale Air Racing Association (GSARA) was held on June 13, 1992, with 12 charter members in attendance. The purpose of this new organization is to establish and standardize rules for R/C unlimited racing, and to promote this new sport event (see our August issue for coverage of the recent Tucson unlimited races). The president of the organization is David Bridi, and the main board consists of Larry Maynard, Dave Johnson, Boyd Hunt and Tom Easterday. A membership fee of $25 per year has been established. If you are interested in finding out more about this organization, contact: GSARA, 1744 Greenwood Ave., Torrance, CA, 90503, or call (310) 212-3257; fax (310) 320-8354.

PLASTIC WRAPS ARE BACK

Our decision earlier this year to discontinue wrapping our issues in plastic has been rescinded, so you can be assured that new copies of *Model Airplane News* will be well protected in their journey through the mails to your mailbox. We are working with our printer to ensure that these plastic wraps are as "environmentally friendly" as possible.

UPCOMING...

Some upcoming events, a couple of which are inaugural, merit brief mention. For ducted-fan fans in the Colorado area, the first JEFCO jet rally will be held on September 26 and 27 at the Chatfield State Park Aerodrome. A lot of energy has gone into planning this event with the hope that it can become one of the dozen or so annual jet rallies of note. For further information, contact Edward Valls, 7265 South Xenia Circle, #B, Englewood, CO 80112. A new hobby show, "Hobbycon East," will be coming to New Jersey on September 12 and 13. It will be held at the Garden State Exhibit Center in Somerset, NJ, and about 25 percent of the more than 200 booths are planned to be R/C. For more information, call (908) 741-7818, or FAX (908) 747-4674.

Finally, the QSAA will sponsor the 16th Annual International Fly-In on October 15 to 18 at the Eldorado Dry Lake near Las Vegas. If you want to see outsize scale masterpieces from around the world, this event usually has some of the best. For information, contact the QSAA, P.O. Box 13980, Las Vegas, NV 89112, (702) 293-0035. ■

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

STEALTH PLANS

After seeing Mr. Whalen's electric F-117A Stealth in "Pilot Projects" (November '91), I've been looking for plans or a kit for the F-117A or the B-2 bomber. So far, I haven't found anything. I'd greatly appreciate any help—from you or anyone else out there. Please print my address so that anyone with information can contact me.

ED BELLMAN
215 Weinland St.
New Carlisle, OH 45344

Ed, after much stone-turning and phone-dialing, we weren't able to uncover any sign of a kit—that is, until we received a news release from Yellow Aircraft. According to the news release, at the Quinte Fan Jet Rally on June 12 to 14, 1992, Bob Fiorenze successfully flew an F-117 Stealth kit prototype at over 140mph. It was reported that Bob was pleasantly surprised at its flying capabilities and that it was very stable in takeoff and had a predictable sink rate. For more information, call or write to Yellow Aircraft, 203 Massachusetts Ave., Lexington, MA 02173; (617) 674-2222. GY

CURRENT INFORMATION

I read with much interest about the Lectric Schtick in your March '92 issue. I've had limited success with a twin trainer powered by two O.S. .40 4-stroke engines. In about one flight in four, an engine would die. I recently "bought the farm" with it and have now written it off! It survived more than two years, so perhaps that's not so bad.

I've designed and built my own 52-inch-span electric twin, and I'd like to confirm its viability and the correct choice of props before I fly it. So, could you please clarify some points in the "Plugging in the Numbers" sidebar in the "Lectric Schtick" article.

- No reference is made to the two motors that are used in the calculation.
- Why use 7 volts in the calculation (113W/7V = 16.1A) when the nominal voltage is 8.4V?
- Where does the 3.7 come from that's used in the calculation of stall speed? (3.7 multiplied by the square root of 18).

My design uses two Graupner 600BB 8.4V motors and weighs 5 pounds complete with two 1400mAh 7-cell packs. I run the packs in series as 14 cells with the motors also in series. I get 10,800rpm on 8x4.5 folding props for about 4 minutes. The current is about 20 amps static, which equals about 360 watts. I think this is well over 60 watts per pound, if you calculate with both motors and packs. With a wing loading of 24 ounces per square foot, am I on the right track to success? Thanks for a great magazine.

JOHN L. BRANSGROVE
Epsom Downs, Surrey, England

See Keith Shaw's article on electric twins in our December '91 issue for an excellent treatment of electric-twin design. Keith is a noted authority on electrics. (One of his latest designs is a twin, electric, ducted-fan, 62-inch-span Horten IX V2b, which is shown on page 11 of our July issue.) The information you refer to is keyed to Keith's article; it shows that the performance Clyde Geist found conforms to the rules of thumb and relationships outlined in Keith's article.

The motors used in the review are stock .020 can motors that come with the Mini Olympus geared motor system sold by Hobby Lobby. These motors are the same size as Graupner Speed 400 motors. Hobby Lobby advises that they provide slightly longer run times, but not quite the power of the Speed 400s.

The reason 7 volts was used in the calculation is that the average voltage of a Ni-Cd cell during a discharge cycle is just over 1 volt. In the May issue of Model Airplane News, I summarized the results of tests of new Panasonic and Sony SCRC cells that are being distributed by Trinity. These top-rated batteries, during 15A and 20A discharges, showed average voltage levels from 1.10 to 1.17 volts. SCE cells

(Continued on page 10)

AIRWAVES

showed a lower average voltage ranging from 1.09 to 1.13 volts.

Keith advises that voltage losses in the wires running from the batteries to the motor will reduce the voltage still further. When he checks out another modeler's electric, he'll often test the voltage at the motor solder tabs while the motor is running full bore. If his voltmeter reads fewer volts than there are batteries, then "it's time to check the plumbing."

Keith Shaw proposed a simple algorithm for a "reasonably accurate estimate" of stall speed in his article. That formula includes the "3.7" you cite. We don't have space here to explain the derivation (we'll address this subject in a future article), but Keith did include his address at the end of the article for any who may wish to write to him about their own electric-twin designs. His address is 2756 Elmwood, Ann Arbor, MI 48104.

Your plane is running 14 cells at 20 amps, which is generating approximately 280 watts. Your design achieves roughly 56 input watts per pound. Keith notes in his article that scale bombers and transports fly well with 40 to 50 watts per pound, and high-performance fighters usually require no more than 60 to 65 watts per pound. With a wing loading of approximately 24 ounces per square foot, your plane has a wing area of about 480 square inches. Keith notes that on very large aircraft, i.e., above 1,000 square inches, 20 to 22 ounces per square foot still gives gentle handling. More aggressive aircraft, e.g., fighters and bombers, fly well with wing loadings of up to 25 ounces per square foot. Better pilot skills will be required. The numbers say your plane will be a more aggressive flying machine than a trainer, but the real question is, how does it perform in the air? We'd like to hear your results.

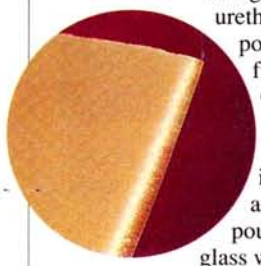
*You may be interested in new software for IBM-compatible PCs called "AERO*COMP" that provides performance characterizations of electrics. It provides answers to the kinds of question you've posed. Write to USR&D Corp. P.O. Box 561, Denville, NJ 07834.* TA

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!

Giant-scale skin



Bill Griggs, one of our correspondents spotted this new miracle material at the KRC Electric Meet. Tufflite is a new fiberglass-skin/polyurethane foam composite material from Boxmeyer Composites. Tufflite appears to be ideal to form around compound curves and glass wings. It is reported to be compatible with CA glues and is fuel-resistant. The wing shown was made in under 20 minutes and features an arrow-shaft spar with balsa ribs every 6 inches. It will tentatively be available in an 1/8-inch thickness—good for large models—and a 1/4-inch thickness. Both will be offered in 2x4-foot and 4x4-foot sheets. In case your flying field doubles as a target range, they tell me the 1/4-inch version shows little damage from small-arms fire! (.38, 9mm, .357 and .45 were all tried).

For more information, contact Boxmeyer Composites, P.O. Box 6165, Philadelphia, PA 16115.

NO TOY SOLDIERS HERE

Military personnel are learning to fly the Hunter Short-Range Unmanned Aerial Vehicle System at Huachuca, AZ. Students begin on a trainer exactly like the ones we use in the hobby and then move on to the 1/3-scale "Mini-Hunter" to hone their skills. Students "external-pilot" then graduate to fly the 1,400-pound, 29-foot-span, full-size Hunter SR-UAV. Shown with the family of UAV vehicles are (left to right): Private First Class Scott Smith, U.S. Army, Staff Sergeant Ray Wyatt, U.S. Marine Corps and Specialist Kristien Burkholder, U.S. Army. The Hunter UAV system, developed by the team of IAI (Israel Aircraft Industries) and TRW Avionics and Surveillance Group, will be used to deliver vital, real-time information to battlefield commanders on day or night missions.

Contact Marvin Klemow IAI at (703) 875-3723, or Janis Lamar TRW at (619) 592-3478.

In a league of its own

In spite of the JR 4721 Ultra Torque servo's standard size (in inches, .73x1.52x1.32), this little bowling ball lifter puts out 119.63 ounce/inches of "umph" with a transit time of 0.17 second on a 4-cell battery pack and 0.14 on a five-cell. JR uses its most advanced coreless motor featuring a resin-impregnated basket, graphite motor bushings and tinned windings.

For more information, see your local hobby dealer, or call JR service at (217) 355-9511. All JR products are exclusively distributed by Hobby Dynamics, a division of Horizon Hobby Distributors.

ROYAL COUPLE

Though these two aren't actually meant for each other, they are both from Royal Products. The new Signature Series .28 (also available as a .25) should interest the fun-fly enthusiast, considering it retails for only $116.95. These new engines both feature ABC piston/sleeve design, Schnuerle porting, fully metered carburetion (that means no air-bleed screw) and ball-bearing front and rear. The muffler also has a removable baffle that reduces noise levels.

Also pictured is the new Chipmunk 40L, which is an almost-ready-to-fly model of all-wood construction that is pre-covered. Spinner, fuel tank, pushrods and wheel are included. The Chipmunk 40L can be built as a conventional model or a tricycle-gear model.

Contact Royal Products Corp., P.O. Box 5026, Denver, CO 80217-5026; (303) 778-7711; fax (303) 778-7721.

AIR SCOOP

True Colors!

If you want to be competitive at scale meets, oil-stains on the bottom of your cowl (even with a scale redolence) won't help if the color of your plane is wrong. To avoid this common mistake, get a WW II color-chip reference guide from M&M/F.T.E. Models. The guide includes color chips for the Luftwaffe, the U.S. Army Air Corps (USAF), the U.S. Navy/Marines, the British Royal Air Force, the Japanese Army/Navy and the Italian Air Force. This guide is not only legal for all AMA and FAI events, but it is also endorsed by the master himself, American Scale Contest Board Chairman David Platt.

To order yours, contact F.T.E. Enterprises 15300 Estancia Ln., West Palm Beach, FL 335414; (407) 795-6600

24 HOURS ALOFT!

At 12:06 p.m. on June 3, 1992, at the Pegasus R/C Club field near Hagerstown, MD, a radio-controlled aeromodel designed by Maynard Hill and developed by a team that included Paul Howey, Tien-Seng Chiu and M. Scott Hill, was launched on a flight that lasted 24 hours, 4 minutes and 15 seconds. This exceeds the current standing record of 22 hours, 19 minutes and 15 seconds set by Gian Maria Aghem of Molinella, Italy. The 102-inch-span model weighed in at 11 pounds fully fueled. Power was a .60 4-stroke engine modified with spark-ignition to run on gasoline for improved efficiency. Since FAI rules permit only team efforts in development, but not in piloting, Maynard controlled the entire flight! He was, however, assisted by an electronic device that kept the craft near a ground-based RF beacon. A small, on-board transmitter with downlink telemetry reported engine rpm, altitude, rudder position and battery voltage. Congratulations, Mr. Hill!

If you would like further information on this historic event, contact John Patton Academy of Model Aeronautics, 8013 Dustin Dr. Fredrick, MD 21701 (301) 898-9111.

Need a ready-built monster?

If so, let mad Dr. Martinstein from Hobby Lobby International build it for you. Now,

the famous 94-inch-span Hobby Lobby Senior Telemaster comes built and covered, ready for your engine and radio equipment. The ready-built Senior Telemaster is constructed entirely of balsa and hardwood with a rib-and-spar wing construction that brings it in at a 10-pound, 8-ounce flying weight. With its low weight and 1,330 square inches of wing area, this ARF version has the same beautifully majestic flight performance that puts the original Telemaster in a class all its own. The wing breaks down into two pieces for easy transportation.

For more, call the Hobby Lobby laboratory at (615) 373-1444 and ask for one of Dr. Martinstein's assistants.

GENTLE JETS

If you've been contemplating your first ducted-fan project but are a bit daunted by the blistering speeds at which some designs eat up the sky, maybe you should investigate a gentle-flying T-33 from Leading Edge Models. I'm told the flight characteristics of the T-Bird are very scale-like yet mild mannered—well within the capabilities of the established Sunday flier. This 64-inch-span Lockheed model is designed around the popular 5-inch fan and incorporates internal ducting to eliminate the need for a drag-inducing cheater hole. The T-Bird semi-kit sells for only $194.95 and requires only sheeting and other balsa parts to be cut from stock sizes readily available at your hobby shop. A pre-cut parts kit is available for $49.95, if you desire that route. Maybe a T-33 is right for your R/C jet training program; do you think full-scale jet pilots jump right into an F-15 on their first day? I don't think so.

For more info, contact Leading Edge Models, 170 Oval Dr., Central Islip, NY 11722; (516) 234-7264; fax (516) 234-9078.

HOW TO

Stressed Skin Design, Part 2

by ANDY LENNON

THIS WILL DETAIL the stressed skin structure of the "Swift"—a model with slotted flaps that's designed for low drag. The Swift is powered by an O.S. Max .46 SF engine and an A.P.C. propeller. Its aerodynamic design was described in Part III of "Improve Performance by Reducing Drag" in the March '92 issue of *Model Airplane News*. This model's structure is based on the principles outlined in Part I.

High-strength, low-drag structure

PHOTOS BY ANDY LENNON

This analysis will deal with:

- wings, ailerons and slotted flaps
- horizontal and vertical tail surfaces
- fuselage
- landing gear
- a simple basis for estimating weight

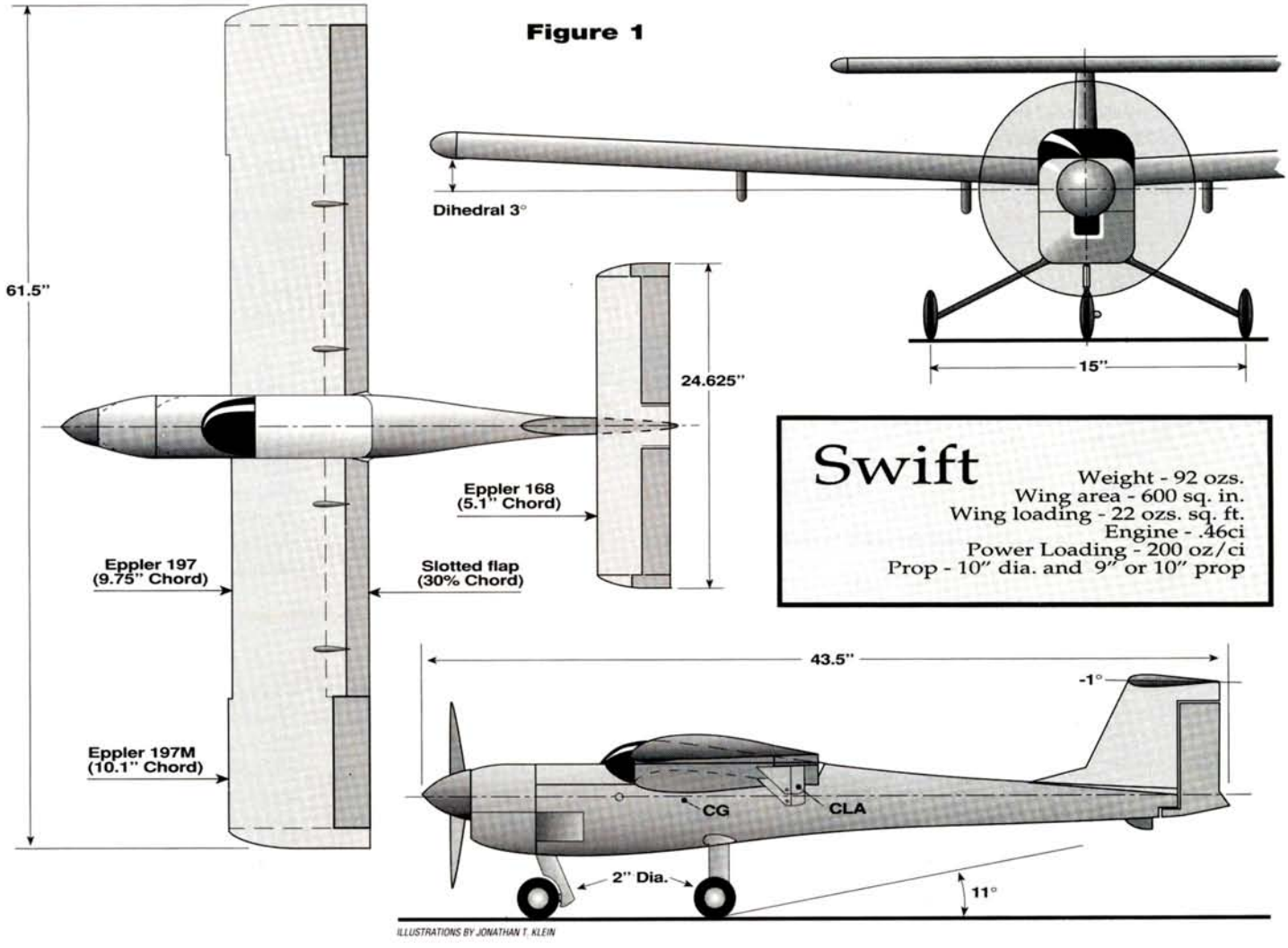
Several photos will provide assembly hints for these components.

WINGS, AILERONS AND SLOTTED FLAPS

Figures 2A and B detail wing structure. "A" is a section cut through the flapped portion, and "B" is cut through the aileron and NASA "drooped" leading edge.

Figure 2A shows the Swift's two-spar wing with vertical-grained webs running from top to bottom flanges and between the wing ribs. The $^3/_{16}$-inch square leading-edge spar adds little strength but provides gluing surfaces for joining top and bottom $^1/_{16}$-inch balsa

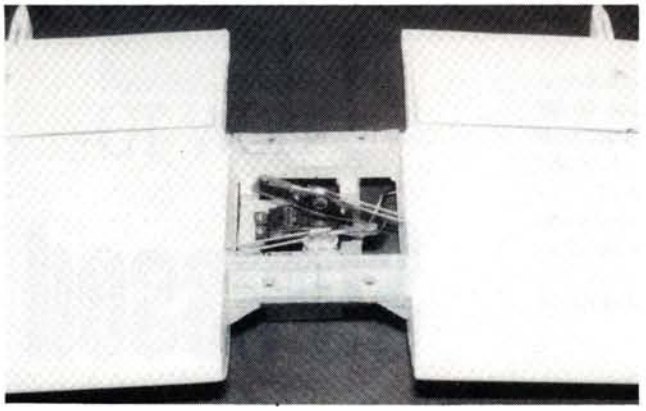
Figure 1



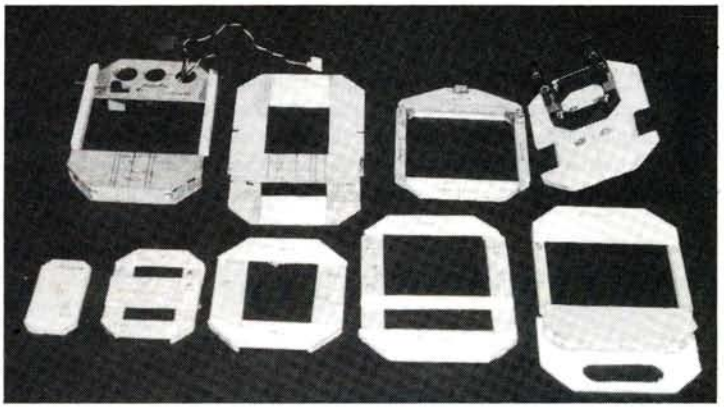
Swift

Weight - 92 ozs.
Wing area - 600 sq. in.
Wing loading - 22 ozs. sq. ft.
Engine - .46ci
Power Loading - 200 oz/ci
Prop - 10" dia. and 9" or 10" prop

ILLUSTRATIONS BY JONATHAN T. KLEIN



1. The Seahawk's wing center section. Note the four-hole bolting and servo accessibility.



2. The Seahawk's fuselage bulkhead sub-assemblies.

Stressed Skin Design, Part 2

(Continued from page 15)

leading-edge skins. The aft spar absorbs the flap drag and lift loads when flaps are extended.

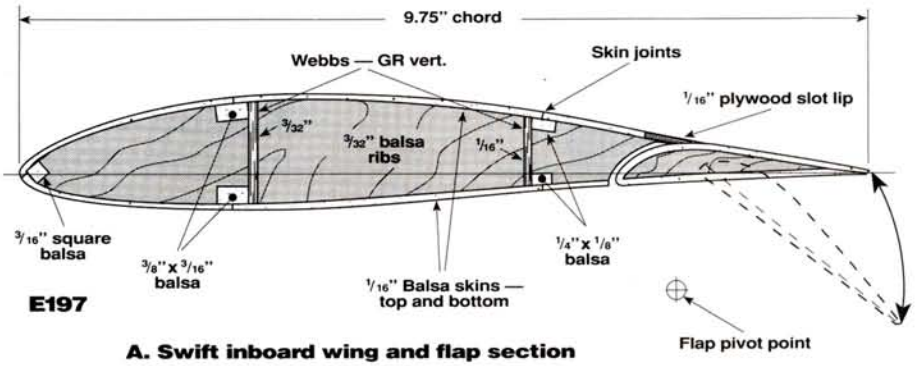
Figure 2B shows the structure at the ailerons designed to resist aileron twisting loads. The diagonal 1/16-inch balsa sheet running from the lower flange of the aft spar to the upper skin stiffens the aileron attachment point. The ailerons and flaps are simple box structures.

The Swift's ailerons are of modified "Frise" design. With equal up and down travel of "barn-door" ailerons, the downward extension produces more drag than the upward one. This uneven drag pulls the wrong way—out of the turn—and requires coordinated rudder to correct the resulting adverse yaw.

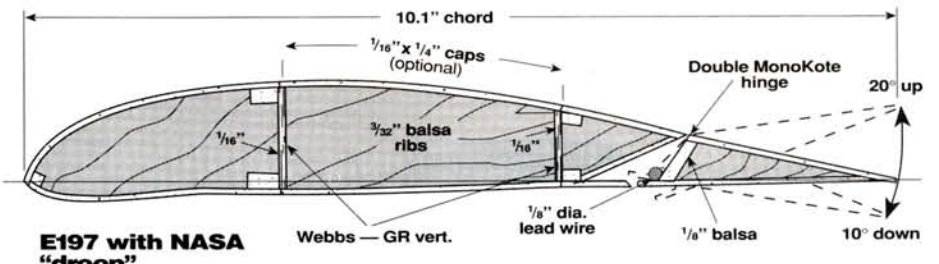
The Swift's ailerons have differential travel—the upgoing moves twice the angle of the downgoing. Also, the lower forward lip of the upgoing aileron projects into the airstream below the wing, producing favorable drag as in Figure 2B.

These two factors combine to produce "into-the-turn" yaw. Rudder action isn't needed; the model turns on aileron action.

Both ailerons and flaps of this construction are strong, stiff units. Note the lead-wire, aileron mass-balance.

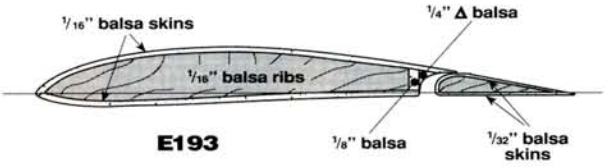


A. Swift inboard wing and flap section

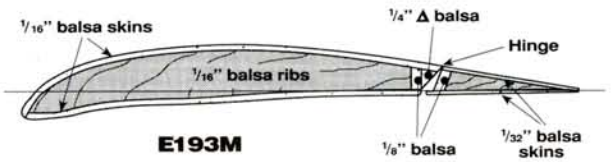


B. Swift outboard wing and aileron section

Figure 2



A. Sparrow Hawk wing and flap section



B. Sparrow Hawk wing construction

Figure 3

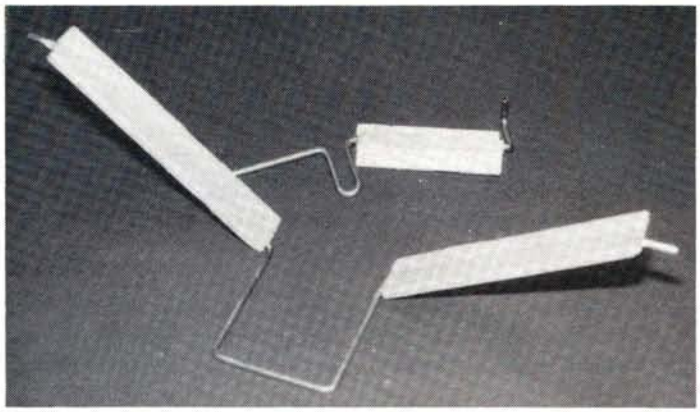
The wing center section is open, as in photo 1, with the center section main and aft spars running across the fuselage. This leaves the center section free for installation of aileron and flap servos where they're accessible by removal of the canopy as in Figure 5. It also provides access to the elevator, rudder and engine servos in the fuselage.

This open center section leaves it relatively weak in torsion. However, the wing is firmly bolted to the fuselage structure at four points. These points are shown in photo 1. The torsion loads are absorbed by the fuselage structure, as are the main landing-gear loads.

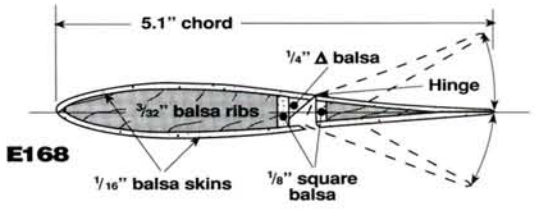
HORIZONTAL AND VERTICAL TAIL SURFACES

Figures 4A and B detail typical cross sections of the Swift's tail. Figure 4A displays the stab and elevator sections. The stab has one spar with tri-stock reinforcing the upper skin at the elevator double-MonoKote hinge.

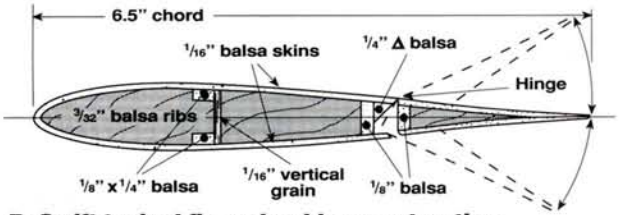
Elevators are composed of 1/8-inch balsa L.E. spar and 1/16-inch



3. The Seahawk's tricycle landing-gear struts with fairings not yet sanded to shape.



A. Swift stab and elevator construction



B. Swift typical fin and rudder construction

Figure 4

balsa skins, top and bottom. Ribs are 3/32-inch balsa sheet.

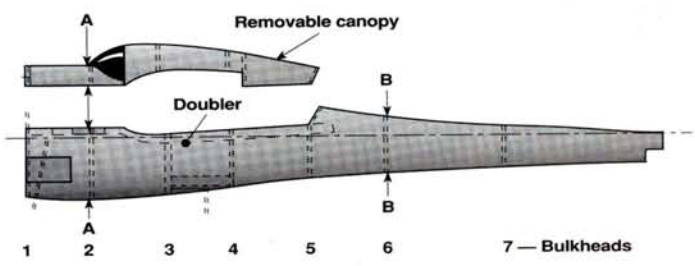
Because the horizontal tail is mounted atop the fin, the fin structure incorporates a spar and shear web, as in Figure 4B, to absorb the loads imposed by this T-tail location. The rudder construction is similar to that of the elevator's.

Figure 4A's construction has been used successfully on small model wings of up to 7-inch chord, as shown in Figures 3A and B. Flaps, ailerons, stabs, elevators, fins and rudders of the small models are all skinned in 1/32-inch balsa sheet with 1/16-inch balsa ribs.

FUSELAGE

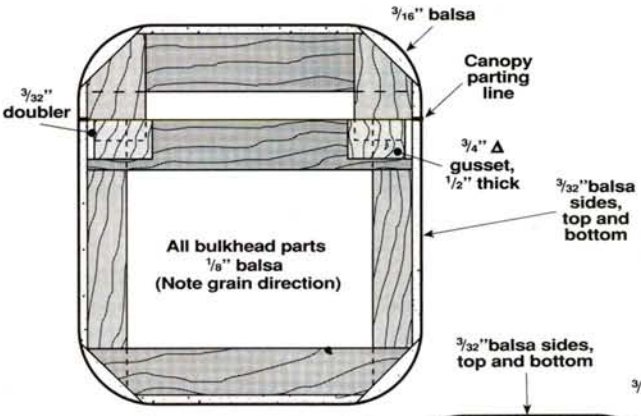
Figure 5 provides an outline of the Swift's fuselage construction and Figures 6 and 7 show typical fuselage sections for models with .40 to .60ci engines.

The sides, top and bottom are all 3/32-inch firm balsa sheet with the grain running lengthwise of the fuselage. The corners are generously radiused and of 3/16-inch balsa sheet. These thicker corners are as far from the neutral axis as possible.

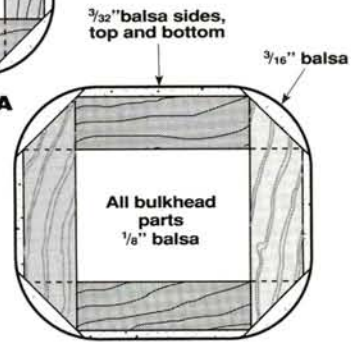


Swift fuselage construction

Figure 5



Fuselage section A-A



Fuselage section B-B

Figure 6

Figure 7

The typical bulkhead (Figure 7) is composed of four separate pieces of 1/8-inch balsa cemented together at the overlapping corners. Note the wood-grain orientation.

The firewall is 3/16-inch plywood and does triple duty. In front are motor mount and cowling, and landing-gear nose-wheel brackets are on the rear. The wing and landing-gear attachment bulkheads are balsa with plywood reinforcement, as in photo 2. The easily removable fuselage top and canopy in Figure 5 weaken the fuselage structure. Beneath the wing, the fuselage is reinforced by the four-bolt, wing-to-fuselage assembly.

Doublers along the fuselage top edges (Figure 5) reinforce these edges, along with triangular gussets at the upper-fuselage to bulkhead corners, as shown in Figure 6.

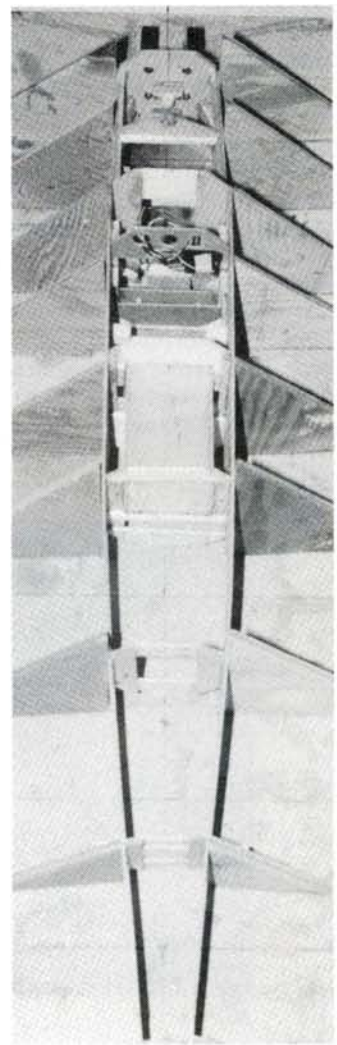
LANDING GEAR

Both main and nose-gear struts are 5/32-inch-diameter music wire as in photo 3. Here, fairings have been added, but not shaped, to streamline cross sections.

The nose strut has a shock-absorbing coil that's entirely inside the fuselage for low drag.

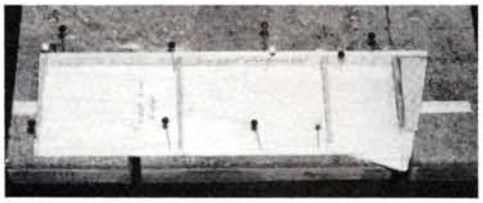
The main struts have a square "U" in that portion in the fuselage that serves two purposes. The horizontal legs are shock-absorbing torsion bars; and they distribute landing loads over the same two bulkheads that absorb wing loads.

(Continued on page 18)

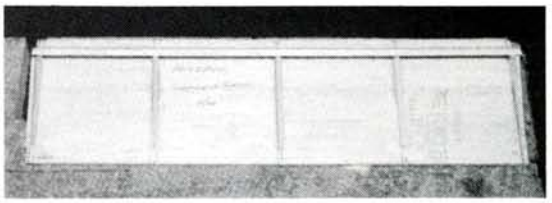


4. Fixture for fuselage assembly.

Stressed Skin Design



5. Rudder assembly in progress.



6. Aileron assembly in process.

WEIGHT ESTIMATING

Estimating the weight of a model airplane while it's still in the conceptual stage is an important and difficult decision.

Over the years, this author has designed, built and flown 14 model aircraft, all radio-controlled, and all of the type of stressed-skin structure described in this series. These are detailed in the chart at right and plotted on the accompanying graph.

The total weight of the 14 was 1151.75 ounces, and their combined wing areas totalled 7,359 square inches; the weight per square inch of wing area was 0.1565 ounces. Power loadings (ounces per cubic inch of engine displacement) varied from 200 to just over 300 ounces per cubic inch displacement (cid). A model that has 625 square inches of wing area would weigh an estimated (625 x 0.1565) or 97.8 ounces.

Obviously, the lower the power loading, the greater the power-to-weight ratio, and the better the climb performance and top speed.

Anyone interested in designing a model to these structural principles, in the 0.15 to .46ci range, will find this tabulation a useful guide. Stressed skin design results in the optimum weight-to-strength ratio.

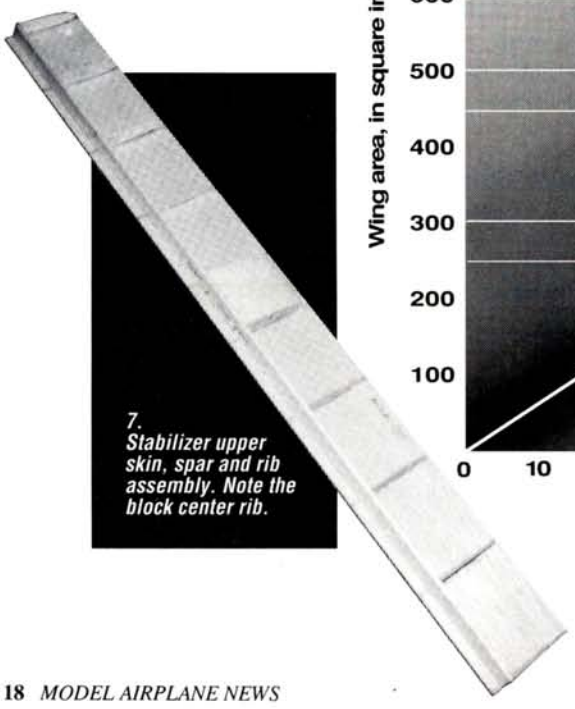
This article and the two preceding articles, "Design for Flaps" and "Improve Performance By Reducing Drag," will hopefully contribute to future, more sophisticated model airplanes.

There are logical justifications for all the Swift's design features—except one—the styling of the lower rudder trailing edge. The author just likes it that way!

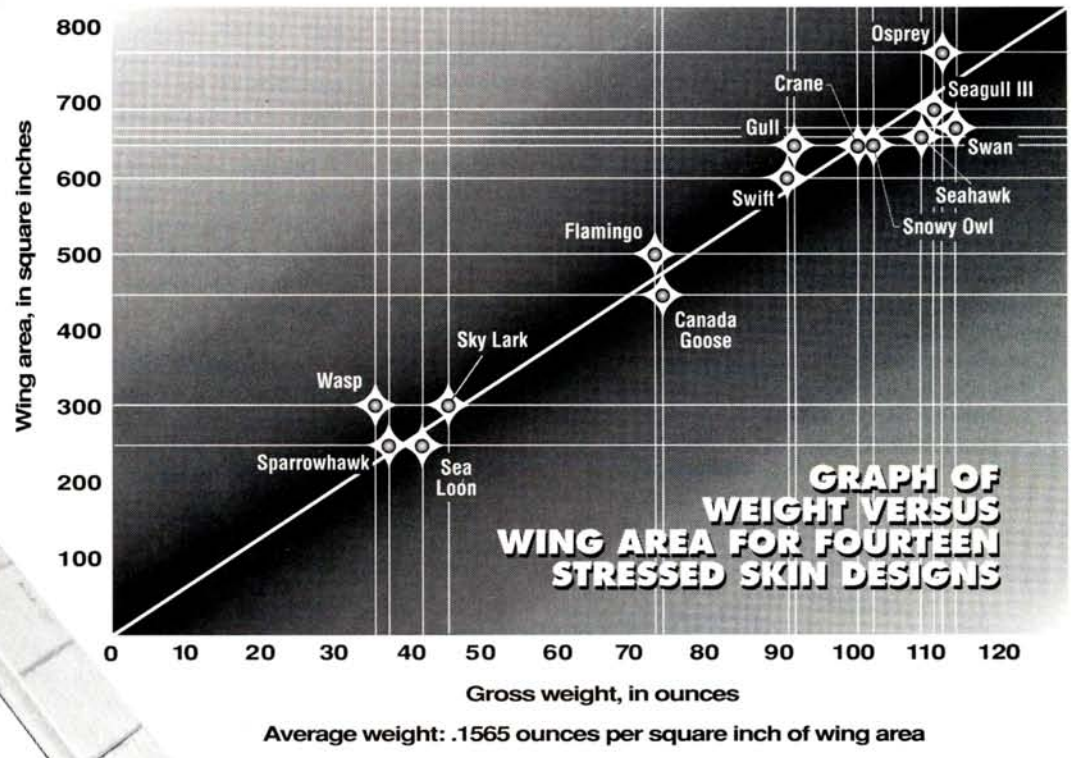
Happy flying. ■

14 STRESSED SKIN DESIGNS

	Model	Eng. disp.	Model type	Gross weight (oz.)	Wing area sq. ins./ sq. ft.	Wing loading ozs./ sq. ft.	Power loading ozs./ci
1.	**Seahawk**	**0.46**	**Sport-Trike**	**110.0**	**655/4.54**	**24.22**	**239.0**
2.	Seagull III	0.46	Flying Boat	112.0	694/4.81	23.28	243.0
3.	**Swift**	**0.46**	**Sport Trike**	**92.0**	**600/4.16**	**22.11**	**200.0**
4.	Osprey	0.45	Tail Dragger	113.0	768/5.33	21.2	251.0
5.	**Swan**	**0.45**	**Canard**	**115.0**	**669/4.64**	**24.78**	**256.0**
6.	Crane	0.45	Stol-Trike	101.5	643/4.46	22.75	226.0
7.	**Gull**	**0.40**	**Sport-Trike**	**93.0**	**643/4.46**	**20.85**	**232.5**
8.	Snowy Owl	0.40	Sport-Trike	104.0	643/4.46	23.31	260.0
9.	**Canada Goose**	**0.35**	**Canard**	**75.0**	**444/3.08**	**24.35**	**214.0**
10.	Flamingo	0.35	Flying Boat	74.0	500/3.47	21.32	211.0
11.	**Sparrowhawk**	**0.15**	**Sport-Trike**	**38.0**	**250/1.73**	**21.96**	**253.0**
12.	Wasp	0.15	Tandem Wing	36.3	300/2.08	17.42	242.0
13.	**Sea Loon**	**0.15**	**Flying Boat**	**42.0**	**250/1.73**	**24.27**	**280.0**
14.	Sky Lark	0.15	Sport-Trike	46.0	300/2.08	22.11	307.0



7. Stabilizer upper skin, spar and rib assembly. Note the block center rib.



Notes: model no. 4, the Osprey, was not fully sheet covered and, hence, was lighter. model no. 5, the Swan, had 12 ounces of lead ballast in the nose to position the CG in the design location. model no. 12, the Wasp, had only four servos, not five.

SEAHAWK

by ANDY LENNON

Fly off land or water

PHOTOS BY ANDY LENNON

THE SEAHAWK IS an older big brother of the Swift (which, as of this writing—late May '92—is being very successfully flight-tested). There is a distinct family resemblance.

The Seahawk may be easily and quickly converted from tricycle landing gear to central and wing-tip floats for water flying. The low-wing configuration permits this change. The horizontal tail is in a conventional location.

SEAHAWK FEATURES

The wing incorporates the NASA safe wing modification (*Model Airplane News*, June 1990) and features Youngman flaps. These are similar to Fowler flaps, but are actuated by two pairs of arms for each flap. They increase the wing's area by 102 square inches and have a coefficient of lift maximum of 2.60 for the area of the wing that is flapped. The basic airfoil section of the Eppler 197, which I'm using on the Swift, has a maximum coefficient of lift of 1.17.

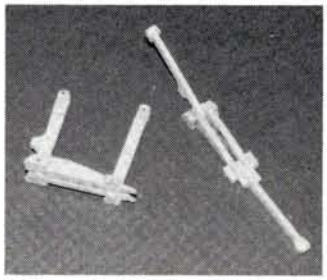
The Youngman flap was a British development and was used on the Fairey Firefly and Gannet, both British naval aircraft. Extension of the Seahawk's big, slotted flaps requires a powerful servo. The Futaba servo S131S with 69.5 ounce/inches of torque proved adequate, provided the model was slowed down at low rpm and in a slight climb. It has since been replaced by a Futaba S125 sail servo of 129 ounce/inches of torque. Flaps extended, landing speeds are in the low 20s in mph. One very pleasing characteristic is that the model noses down gently on flap extension. The nose-down pitch of the deployed flaps must exceed the nose-up pitch generated by the increase in the angle of downwash impacting on the horizontal tail.

SPECIFICATIONS

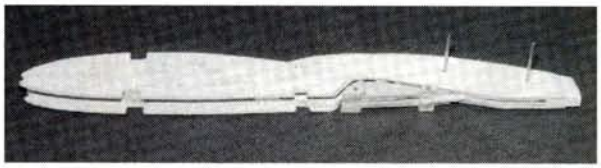
Wing span: 64 inches
Wing area: 655 square inches (4.54 square feet)
Gross weight: Land—110 ounces; water—121 ounces
Wing loadings: Land—24.3 ounces/square feet; water—26.6 ounces/square feet
Engine: O.S* Max .46 SF
Prop: 11x8 APC
Power loadings: Land—239.9 ounces/cubic inches displacement; water—263 ounces/cubic inches displacement
Central float beam loading: 3.36 ounces/square inches
Sections: Wing—Eppler E197; Tail—Eppler E168
Flap area: 102 square inches
Flap type: Youngman flap

This model's structure is based on the principles outlined in the recent articles on stressed-skin design (see the September and October '92 issues of *Model Airplane News*).

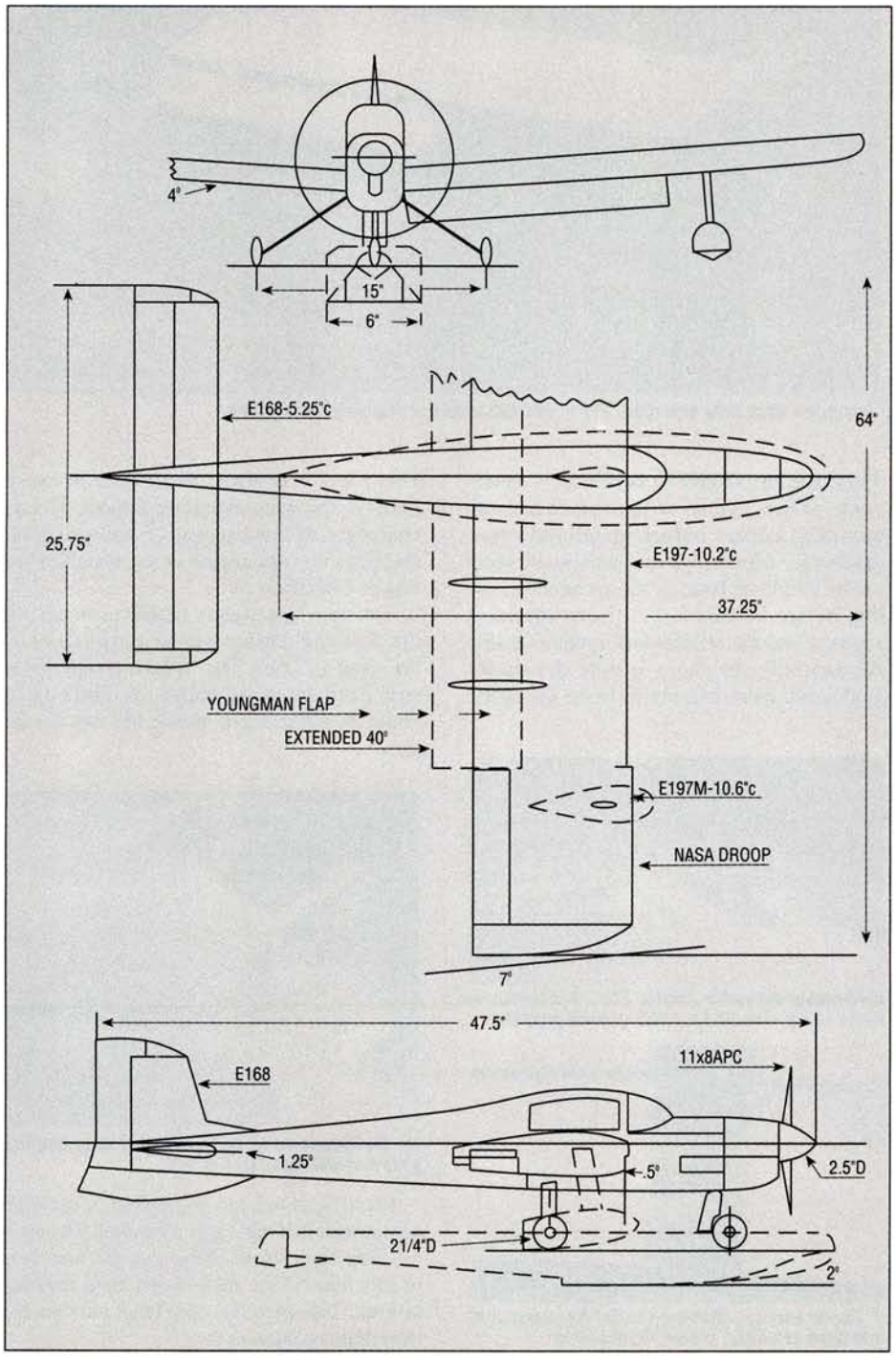
The design of the central and wing-tip floats are detailed in *RCM* articles on hull and float design, (February, March and April 1991). The central float is based on the short after-body hull, with a stern-post angle of 8 degrees. Its beam is 6 inches at its widest point.



1. Two sets of flap arms.



2. Flap-support ribs and fairings showing the flap retracted.

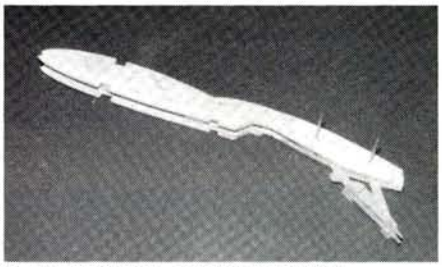


CONSTRUCTION

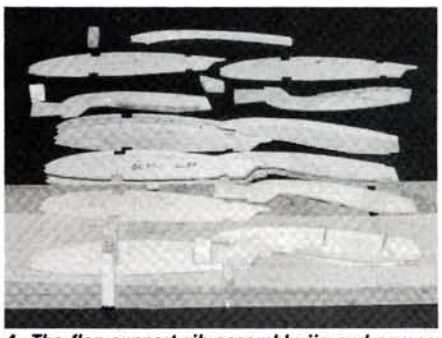
This isn't a beginner's model. For a reasonably experienced modeler, the drawings and photographs provide ample detail for "kitting" the various metal, plastic, plywood and balsa sheet, strip and block parts.

The Seahawk may be easily and quickly converted from tricycle landing gear to central and wing-tip floats for water flying.

The following focuses on assembly procedures and sequence. For example, the 1/8-inch brass tube on the elevator's 3/32-inch wire horn should be slipped onto the wire before making the second bend, for obvious reasons. Let's start with assembly of the component parts of the Youngman flaps.



3. Flaps extended, showing flap action.



4. The flap-support rib-assembly jig and component parts and assemblies.

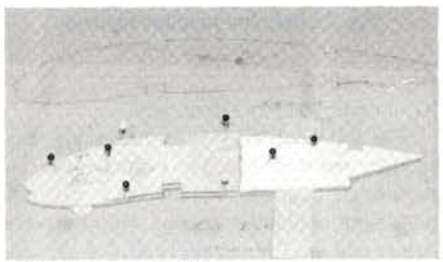
YOUNGMAN FLAPS

Start by assembling four sets of ply arms and flap ribs as shown in the drawings and in photo 1. Four sets of support ribs are

5. Flap assembly in progress.

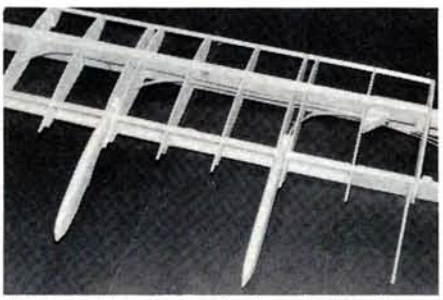
needed. Photos 2 and 3 illustrate how the arms and supports function as the flaps are extended. Photo 4 shows the jig for these assemblies; note the two completed assemblies and various components. Accurate location or pivots is essential.

Photo 5 shows the assembly of flap skins, ribs and arms. The upper skin leading edges have been glued to those of the lower skins.



6. Rib I—assembly fixture

The strip of plastic film under the leading edges will help you avoid cementing the flaps to the base. Soften the top surface of the upper skins with liquid ammonia, and carefully glue the skins to the ribs and lower skin trailing edge. Sand the flaps to the dimensions of the drawing.

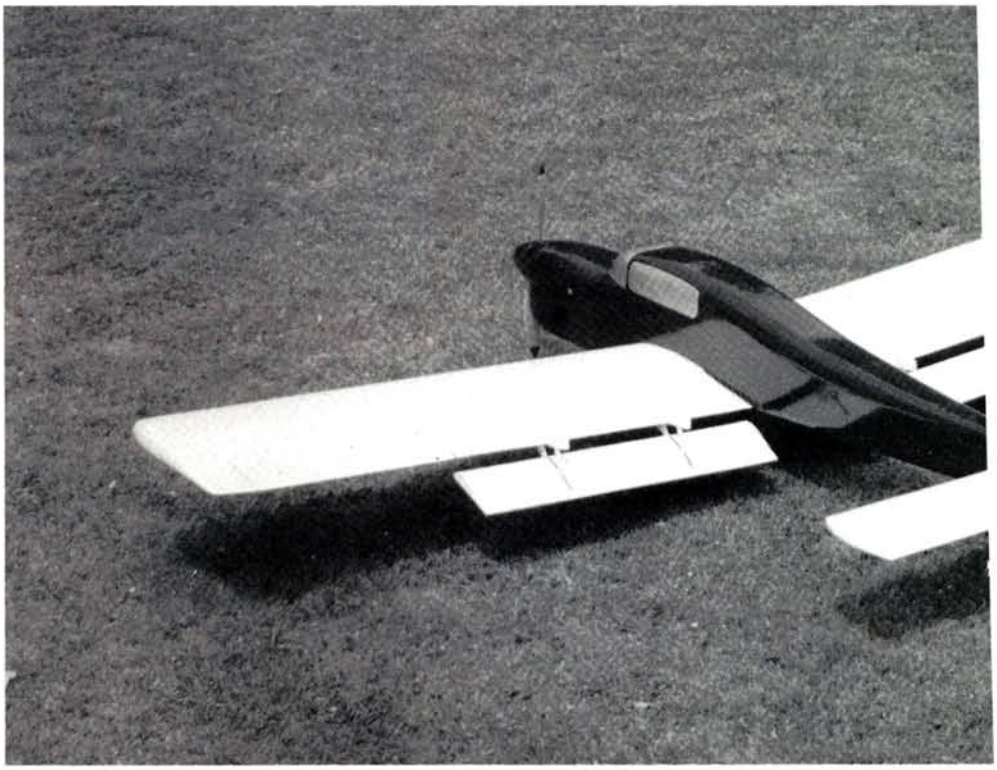


7. The unskinned wing structure showing flap and aileron cable sheaths installed.

WINGS

In addition to the four sets of flap-support ribs (photo 4), other sub-assemblies precede wing assembly. These are rib H, rib A and rib I, forming the wing-tip, float-strut sockets in photo 6.

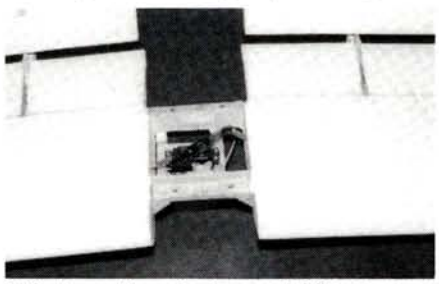
The flap-support ribs in photo 7 position the flaps in relation to the wing itself. Carefully use the flaps for this purpose. Photo 7 also shows the cable plastic sheaths for aileron and flap in the left wing panel.



Youngman flaps fully extended. These add 102 square inches to the wing area.

These sheaths should be bent over a candle flame or heat gun so as to produce smooth, unkinked curves before installation (see drawing). Similarly, the Sullivan* steel cables should be bent, as shown on the drawing, before installation. Silicone lubricant squirted into the sheaths will reduce friction substantially. In photo 7, note the sheath guides and balsa-and-ply webs on the spars.

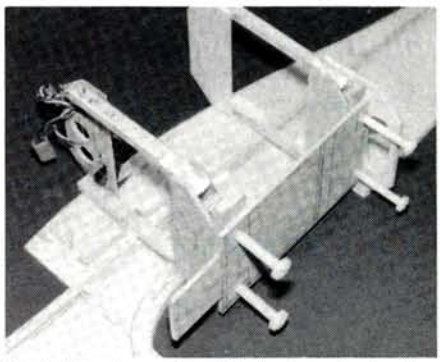
8. The wing-assembly fixture. The 1/4-inch-square balsa strips beneath the spars provide support.



9. Center section, showing special flap servo arm and flaps extended, viewed from below.

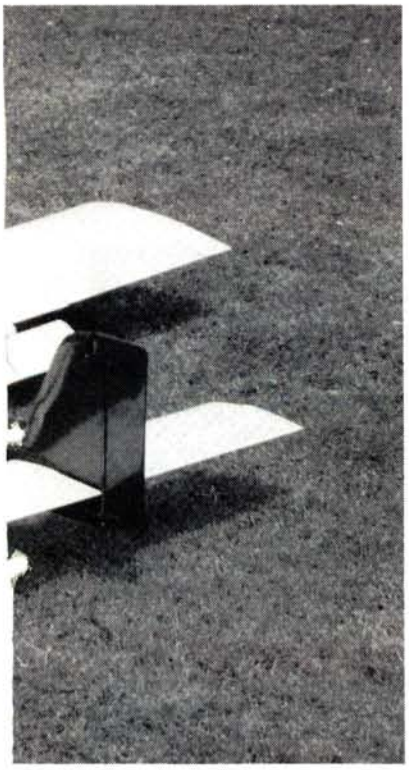
This panel is ready to be skinned. Photo 8 portrays the wing-assembly fixture. This is composed of three pieces of pressed-wood shelving; two are angled at the wing's dihedral of 4 degrees.

The drawings, lightly rubber-cemented to the shelving, ensure proper positioning of the spars and ribs. The 1/4-inch-square balsa strips run spanwise under the spars as in photo 8. Raise them above the surface as shown.



10. Bulkheads no. 4 and 5 showing wing landing gear and fuselage attachment.

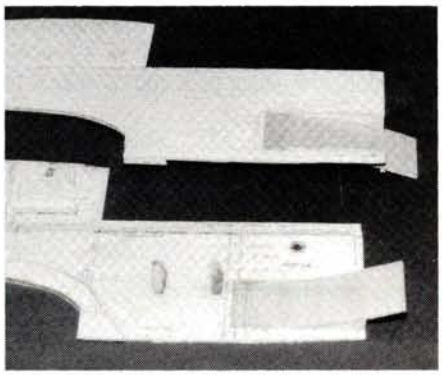
Photo 9 shows the completed wing with servos installed and flaps extended. The special flap horn shows. Note that the rear arm of this horn is 5/32 inch longer than the one in front. This provides equal flap movement. (See drawing Plate 2.)



FUSELAGE

Sub-assemblies for the fuselage are:

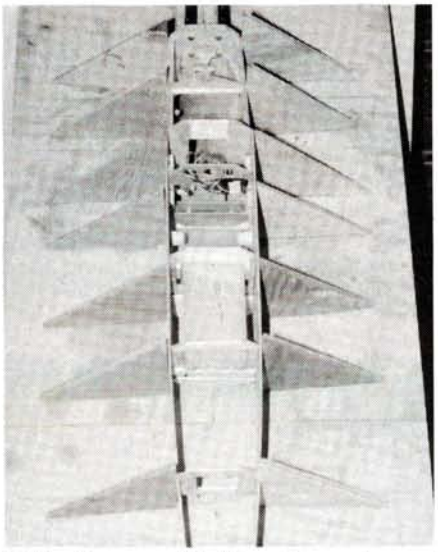
- Bulkhead no. 1 with nose-wheel brackets bolted on the back and the motor mount bolted in front.



11. Details of cooling outlets in fuselage sides.

- Bulkheads 2, 3, 5, 6, 7 and 8 as per drawings, Plate 1.
- Bulkhead no. 4 and the receiver on-off switch.

Photo 10 shows the positioning of bulkheads 4 and 5 so that bolt holes in the bulkheads, wing mounts and landing-gear or float mounts will be correctly aligned. Note the over-wing doubler and 1/4-inch-square balsa servo rail mounts.



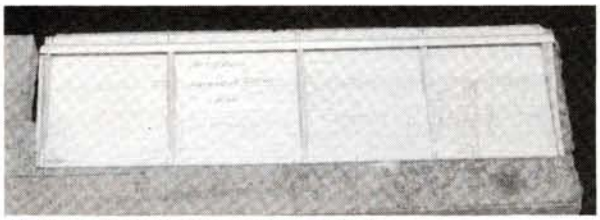
12. Fuselage-assembly fixture. The receiver and battery box are installed.

Photo 11 shows the side-skin sub-assemblies—cooling air outlets, a ply servo mount for the engine and a hole for the glow-plug heating jack.

Photo 12 is of the fuselage assembly jig with bulkheads, side skins and battery-receiver box installed.

While the frame is in the fixture in photo 12, install elevator and rudder cable sheaths, ply servo rails, and receiver and battery. Run the aerial through the 1/8-inch-diameter holes in bulkheads. It will end up in the fin.

Add top and bottom skins; corners are last. See Plate 3 (and photo 19) for corner treatment.



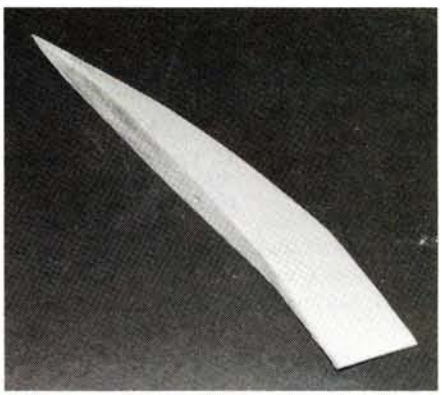
13. Aileron assembly in progress—typical.

CONTROL AND TAIL SURFACES

Photo 13 shows typical construction of ailerons, elevators and rudder. Note that a ply rudder horn is used.

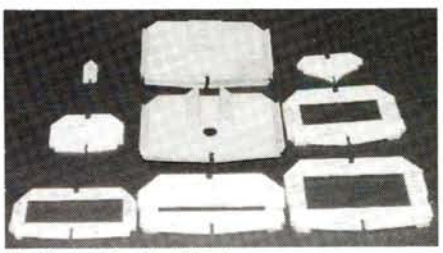
14. Elevators and stab taped together ready for MonoKote covering.

The vertical fin is best installed on the fuselage. Take care to thread the radio's aerial through the holes in the fin ribs. Align the fin vertically, add side skins and dorsal fin block, and sand to conform to the drawing. The stab is assembled on a flat surface, top skin down. Use 3/4-inch triangular stock strip to raise the leading edge to conform to the rib contours. Add spars, ribs and top skin. Photo 14 shows the horizontal tail plane with elevators masking-taped in position ready for MonoKote* covering and elevator hinging. Plate 3 provides the hinging/covering sequence. It's recommended that you cover this assembly before you install it in the fuselage.



15. The detachable ventral fin used for water flying. The 3/16-inch D dowels haven't been installed.

Photo 15 details construction of the ventral fin. It's easily installed for water flying and provides directional stability for flying on floats. The 3/16-inch diameter dowels haven't been installed in these photos.



16. Central float bulkheads.

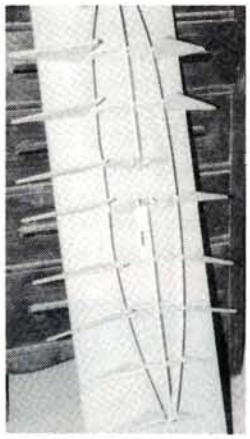
The "double" aileron servo horn shown on Plate 2 provides a 2:1 differential. The upgoing aileron moves much more than the downgoing, eliminating adverse aileron yaw. Use of rudder for turns isn't needed.

CENTRAL AND WING-TIP FLOATS

Photo 16 is of the central float bulkheads.

Bulkhead nos. 2 to 7 are sub-assemblies; nos. 1 to 9 are balsa sheet.

Assemble the central float as depicted in photo 17. At this point, install the water-rudder ply servo mount, the servo, and the sheath and cable from servo to water rudder horn. Add top skins, 1/4-inch-square balsa chin strips, keels and bottom skins. Nose and stern blocks are then installed and shaped. Water rudder and hinge are glued with CA.



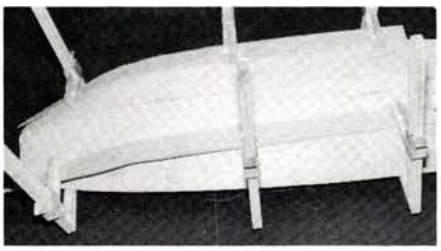
17. Central float assembly fixture—the water-rudder ply servo mount shows.

18. The assembled and shaped float strut. The raised portion has been deleted from the drawings.

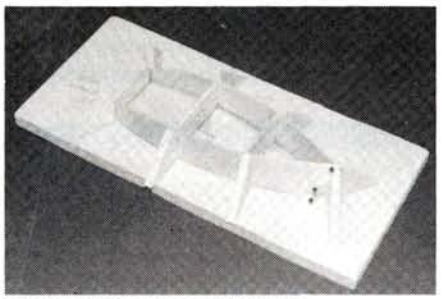
Photo 18 portrays the assembled and shaped float strut. The upper forward turret has been deleted from the Plate 3 drawings as unnecessary. Note the servo-cable channel. This unit is to be installed in the "in-fuselage" mount—but not in the float until last.

Photo 19 shows how to obtain the outline of the float upper 3/16-inch-balsa corner strips using transparent paper. The procedure for assembling these strips, for both fuselage and float, is given on Plate 3.

19. Tracing paper pinned to the float-top corner and marked to show outline for 3/16-inch-thick corner sheeting.

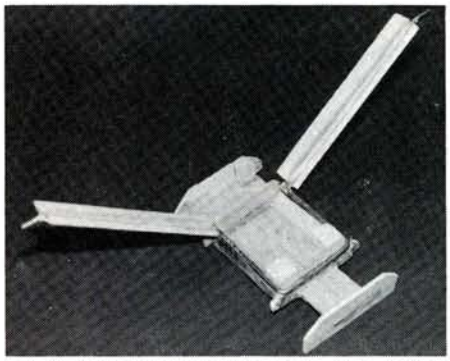


20. Chine flare spray strips are clamped to the forebody bottom while cement sets.

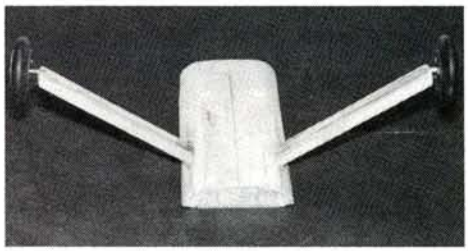


21. Wing-tip float-assembly fixture.

Photo 20 shows the chine flare spray strips clamped in position while the cement is setting up. Photo 21 is of the wing-tip float assembly. Top and bottom sheeting is applied next. Top and nose blocks are then added and shaped.



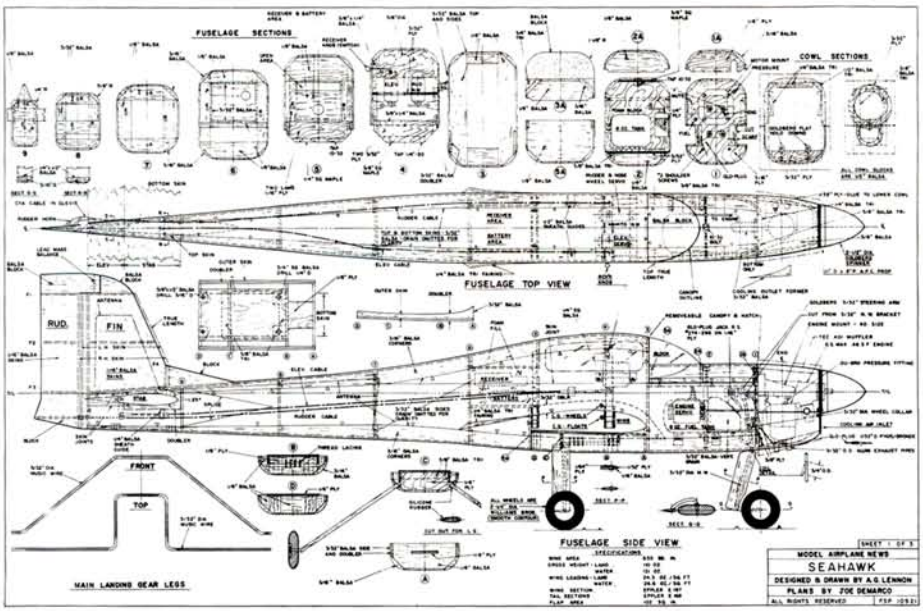
22. Main landing gear installed. Note bolting blocks.



23. The completed main landing-gear assembly.

LANDING GEAR

The 5/32-inch-diameter music-wire landing-gear legs have fairings shaped to streamline the cross section. The U-bend in the nose-wheel leg is replaced by a coil as shown in



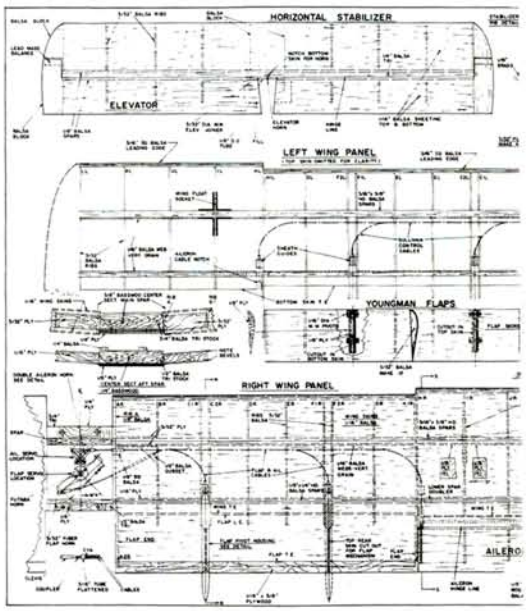
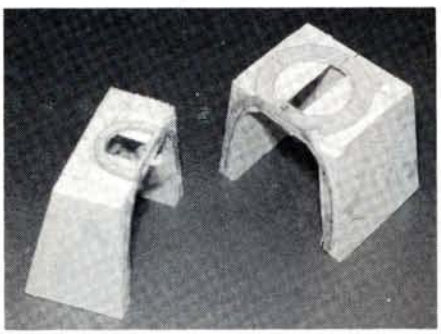


Plate 1 of the drawings and will prove more rugged.

Photo 22 shows the main-gear installation in the "in-fuselage" landing-gear mount. Note the four balsa bolting blocks. Photo 23 shows the finished main landing-gear assembly.

The float strut is assembled into a similar structure as detailed on Plate 3. For water flying, the central float assembly replaces



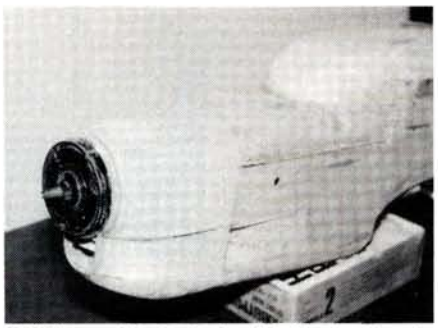
24. The cowl sub-assemblies ready for shaping inside and out.

the main landing-gear assembly; the nosewheel gear is removed by loosening the steering-arm screw, and the ventral fin is plugged into position.

ENGINE COWL

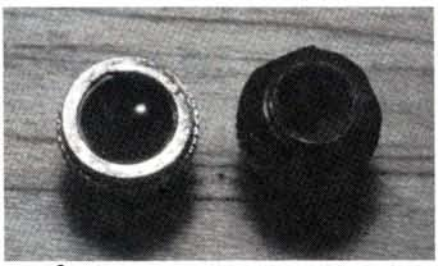
Photo 24 is of the 1/2-inch balsa sheet and ply parts assembly; the lower portion is hollowed out. In photo 25, the cowl has been tack-glued to the fuselage and shaped and sanded to fit the drawing. An old 2 1/2-inch-diameter spinner backplate guides the shaping of the ply spinner ring. The engine was installed at this point.

On final assembly, the upper cowl is gled



25. The cowling tack-glued to the fuselage for external shaping and sanding. An old, 2 1/2-inch-diameter spinner backplate is useful.

with CA to bulkhead no. 1 as shown on Plate 1. Install 3/32-inch ply with two Goldberg* hold-downs to the lower cowl to hold the rear lower cowl. Photo 24 shows the single, front, flat hold-down in position.



26. A 5/32-inch steel ball in screened half of two-piece aluminum fuel-line filter.

CONTROL-SURFACE BALANCING

As the drawings show, the ailerons, the elevators and the air rudder are mass-balanced by weights (lead sheet or wire) ahead of the hinge line. This technique brings the surfaces' CG to the hinge line and prevents potentially damaging flutter. (It's a full-scale practice).

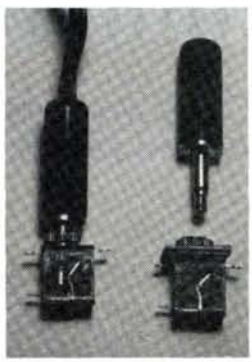
The Seahawk is very clean aerodynamically and can achieve very high speeds in diving. This author has used surface mass balancing on many fast models—with no flutter. It's inexpensive insurance.

CG LOCATION

Plate 1 shows the CG location at 25 percent of the wing's mean aerodynamic chord. Add ballast as required to achieve this CG location.

ENGINE STARTING

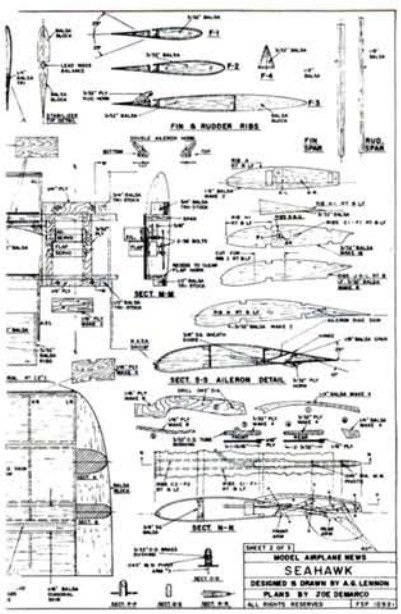
To avoid lower cowl removal, and for safety, the glow plug is energized by a plug wired to the external power source and inserted in a jack situated well away from that dangerous rotating prop as shown on Plate 1 and in photo 27.

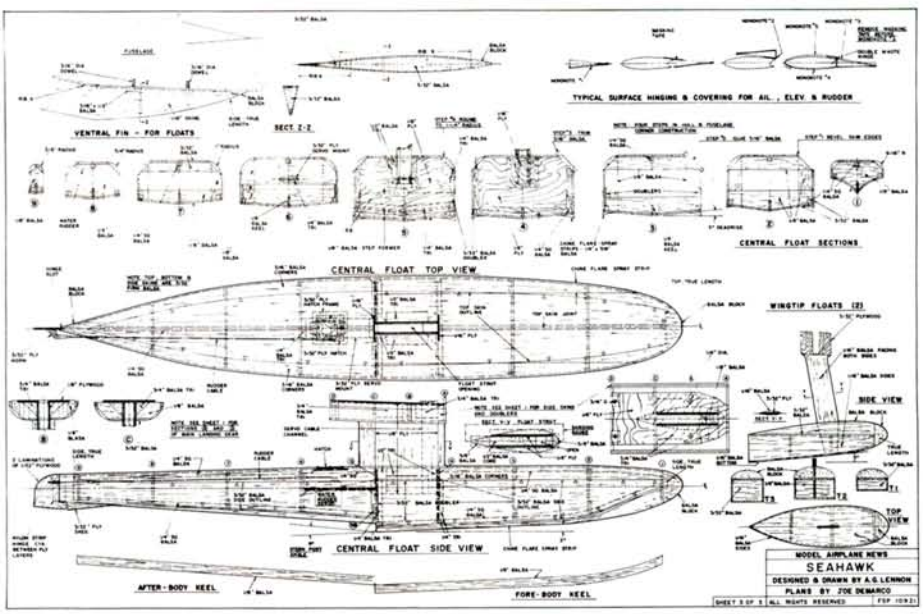


27. Jack and plug for glow-plug heating. Jack is well away from the dangerous prop. Radio Shack No. Jack 274-296, Plug 274-286

Starting the engine with the model inverted on your field box brings the engine upright for easier starting and avoids hydraulic lock that may occur when starting an inverted engine. Fuel and oil trapped above the cylinder head and under the piston can result in engine damage

(Continued on page 105)





HOW TO

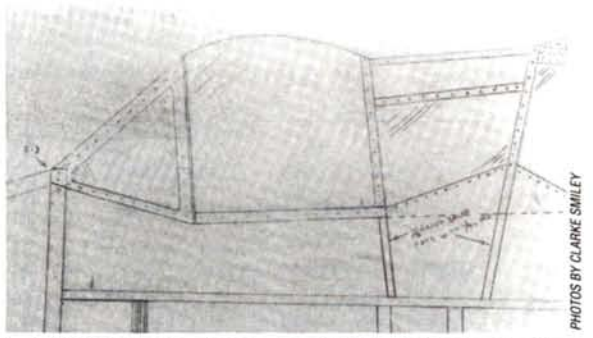
Vacu-Form Your Own Canopies

Custom-form canopies, cowls, wheel pants and more

by CLARKE SMILEY

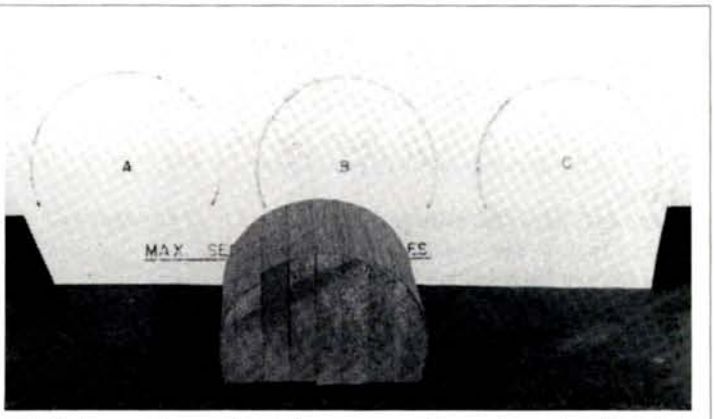
WHEN I DRAW up a set of plans for a new design, I try to identify the most difficult parts to build at the outset. I like to solve these problems before I dive into the rest of the project.

Recently, I've been working on a scale model of the Fairey Gannet, a British anti-submarine aircraft from the '50s. The first major challenge was the canopy. It contains globe-shaped sections. The best way to create this shape is by vacu-forming. This article summarizes the technique I use when vacu-forming canopies and other parts, such as cowls and wheel pants. The photos and captions outline the process, but be sure to look at the general tips noted below as well.



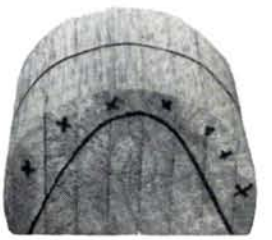
PHOTOS BY CLARKE SMILEY

1 *This is my side-view drawing of the forward cockpit section of the Fairey Gannet. Although the front of the cockpit is like any three-piece, flat-plate wind screen, the center section is globe-shaped. This is the "hard" part.*



2 *To the rear of my rough-cut plug you can see the maximum diameters of the canopy sections to be formed. To make the plug core, I cut out several pieces of balsa sheet and laminated them with Hot Stuff*. I then drew the circular section with a compass. I carved the plug with a razor saw and coarse sandpaper.*

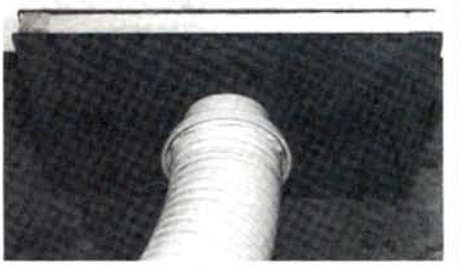
3 *Here, I have marked a center line. Avoid cutting into the line as you carve the front and rear portions of the section canopy.*



4 *The rear section of the front canopy has been marked out. The X's mark wood that should be removed.*

5 *This picture shows the front profile. Note the "A-frame" shape. You can see the mid-section line is still visible. Almost all of the wood has been removed by carving, and the plug is ready for final sanding and an epoxy finish. I finish the plug with epoxy resin and one layer of 2-ounce cloth. After the first coat of resin has cured, remove any hills and valleys by sanding. Try not to sand into the cloth. Apply a second coat of resin.*

After this coat has cured, wet-sand the plug with 400-grit wet-or-dry paper. (A drop of dishwashing liquid in the water keeps the paper from clogging.) At this point, you should be able to hold the plug up to the light and check for any shiny spots. These are "valleys," and if they're deep enough, you may have to coat the plug a third time with resin. Hold the plug up to the light—if it appears to be "frosted" or dull, it's almost ready for use. At this point, a light wet-sanding with 600-grit wet-or-dry will give a perfect finish.



6 *This is a view of the underside of my 7x6-inch vacuum table. To make a vacuum table, you'll need a small piece of pegboard; a small piece of Masonite or pine board; and pine strips roughly 5/8x5/8 inch in cross section. Cut a piece of pegboard and a piece of Masonite of the same size. The pegboard will be the top of the table, and the Masonite the bottom surface. Cut out a hole in the Masonite for the vacuum source. Glue the pine strips to the Masonite as shown, and glue the pegboard to the top. Now you're ready to make a canopy.*

HEATING THE PLASTIC

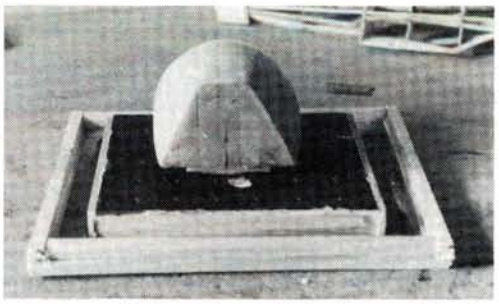
I leave the shop vac running while heating the material to be formed. Although some modelers will hold the framed plastic, with gloved hands, about a foot above an electric oven burner to heat it (gas burners should not be used), this technique isn't recommended because the plastic is flammable. A better approach is to construct an oven that uses a modeling heat gun as a heating element. This is fairly easy to do. (See "How To Form Giant-Scale Canopies" by Jerry Nelson, May '92 *Model Airplane News*.)

I think that heating the butyrate sheet is probably the most difficult part of this whole process. As it's heated, the sheet will first appear to loosen in the frame, then it will appear to tighten. After this, it will begin to sag. This is what you're looking for. Quickly move the frame over the vacuum table and push downward. As the frame reaches the table's edge, the vacuum will draw the sheet around the plug faster than you'd believe.

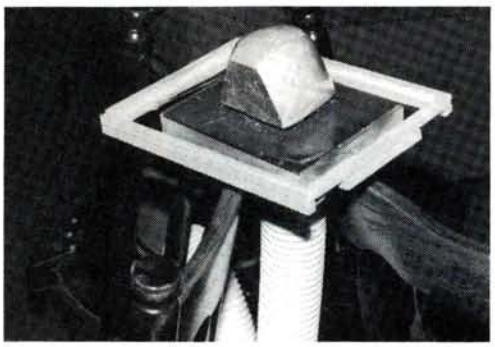
Three cautions: don't overheat the butyrate sheet, it will bubble; butyrate sheet is flammable, so have a good fire extinguisher handy; and wear leather gloves and eye protection.

OPTIONAL RELEASE AGENT

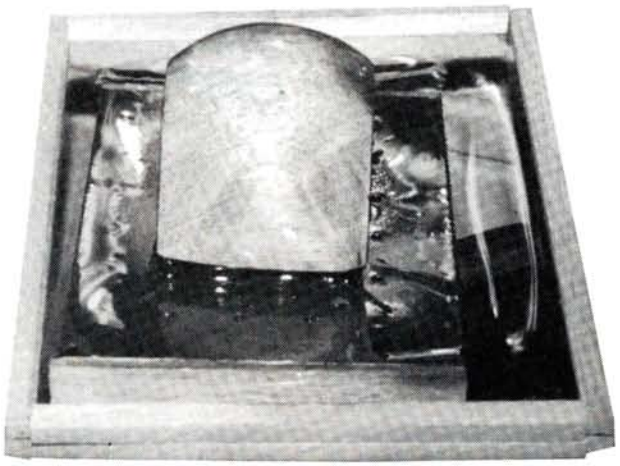
Don't use polyester resin when you build the plug, because this will tend to make the formed plastic adhere to the plug during the vacuforming process. Although a release agent isn't required when using epoxy, some modelers do use one, e.g., baby powder, to ensure easy release of the canopy. However, some of the baby powder will become embedded in the inside surface of the canopy during the forming process and will have to be removed by polishing that surface.



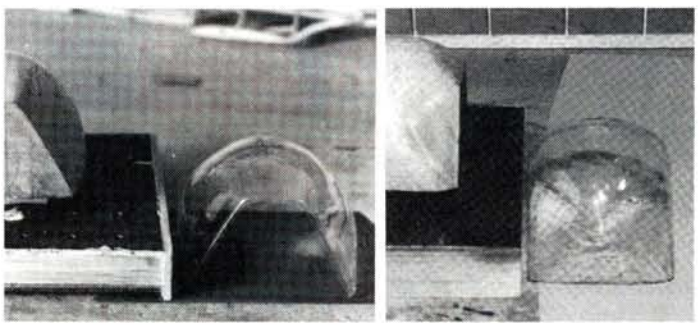
7 *The epoxy-finished plug is mounted on small rails of scrap balsa on top of the table. This keeps the holes in the pegboard under the plug open. The scrap balsa frame around the vacuum table is used to hold the butyrate sheet for heating. Glue the butyrate to this frame before heating and forming.*



8 *A sheet of butyrate has been heated and been pulled down around the canopy form until the four sides contact the table. When this happens the vacuum created by the shop vac does all the rest. I use K&S 0.030-inch-thick butyrate sheet for a part this size (0.030 to 0.040 thicknesses are typically used). You'll find that the forming material will be stretched and thinned in places during the forming process. If larger parts are needed, use thicker materials.*



9 *Note how evenly the butyrate has been formed over the plug—it has also been drawn slightly underneath the plug.*



10 *The completed canopy has been cut free of the plug. In these views, the globe shape is quite clear. Think of all the lightweight model parts that can be formed for free flight and small rubber models!*

FOR CLEARER CANOPIES

If you want to minimize the minor distortions that can result from using a wooden plug, you can polish the inside of the formed canopy with automotive polishing compound. The most distortion-free, clear canopies are formed over professionally cast plugs made of special, industrial-grade tooling epoxy. If you're looking for a canopy of that quality, Lanier R/C* will do custom work on a one-off basis. It will cost a little more, and you'll miss out on the fun of making your own.

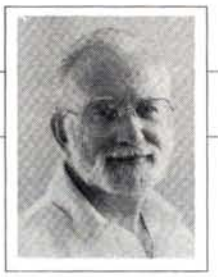
SOURCES

The plastics commonly used for vacu-forming are butyrate, acetate, ABS and polystyrene (vinyl). These materials can be purchased from such companies as Lanier RC, Sig Mfg.*, NH Plastics* (polystyrene), K&S Engineering* and Aircraft Spruce and Specialty Company*, which distributes a wide variety of heat-formable materials, including one of my favorites, 0.030-inch-thick acetate in 20x50-inch sheets.

The technique shown can be used to make a wide variety of cowls, wheel pants and other molded parts. Give it a try! If I can help you out with a problem, feel free to contact me at 23 River Bend, Newmarket, NH 03857; (603) 659-3380.

**Here are the addresses of the companies mentioned in this article:*
***Lanier RC**, P.O. Box 458, 4460 Oakwood Rd., Oakwood, GA 30566; (404) 532-6401.*
***Sig Mfg. Co.**, 401 S. Front St., Montezuma, IA 50171; (515) 623-5154.*
***NH Plastics Inc.**, 315 Bouchard St., Manchester, NH 03103; (603) 669-8523.*
***K&S Engineering**, 6917 W 59th St., Chicago, IL 60638.*
***Aircraft Spruce and Specialty Co.**, P.O. Box 424, Fullerton, CA 92632.* ■

How To:

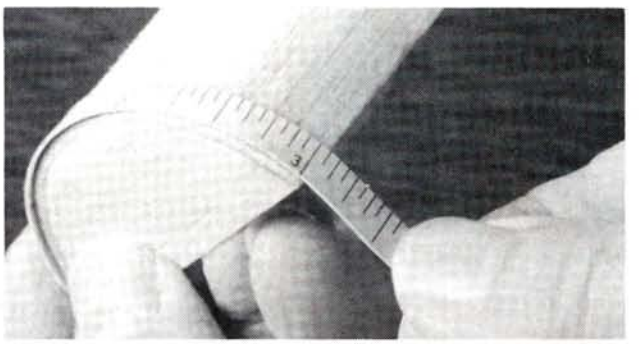


RANDY RANDOLPH

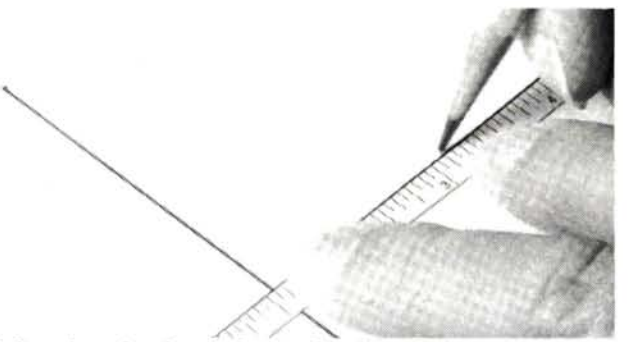
MAKE WINDSHIELDS THAT FIT

MAKING a square cockpit windshield is a snap, but making a rounded one is a little more difficult. The photos show how to avoid the time-consuming "cut-and-try" method. You'll need a tape measure or a flexible ruler, a compass and a protractor.

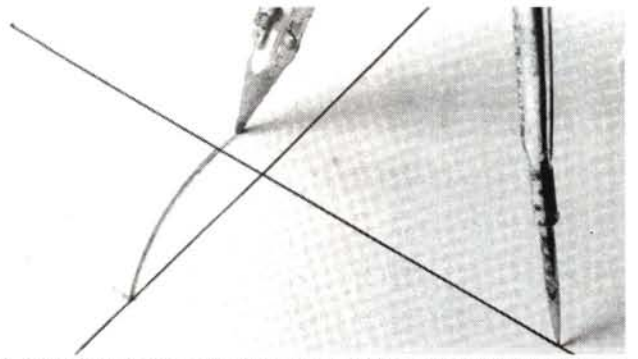
Errata: *in the August "How To," column, the weight of the carbon-fiber mat used should have been specified as .2 and .4 ounce.*



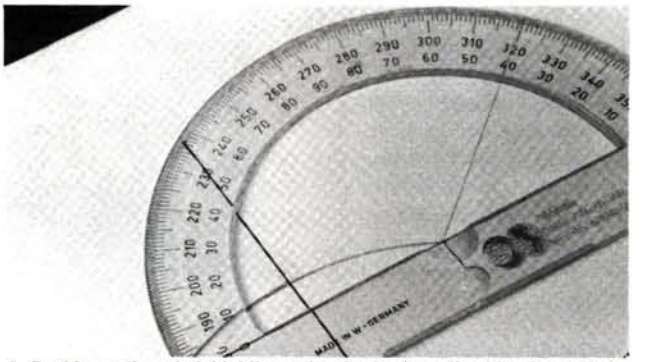
1. Use the tape measure or ruler to measure around the top of the fuselage where the windshield will be mounted. (The fuselage shown measures about 3 inches.)



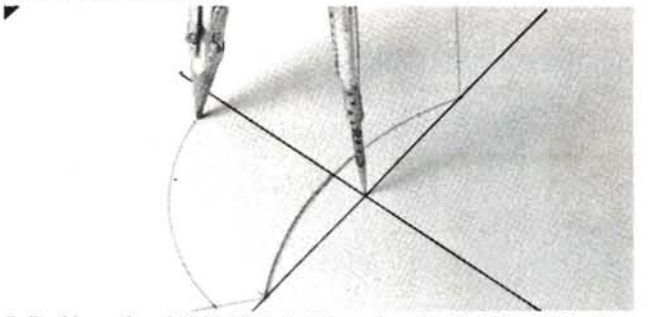
2. On a piece of card stock, draw two long lines that intersect each other at a right angle. On one of the lines (call it the "base line"), make marks on either side of the intersection at distances that are half the measurement you made in Step 1.



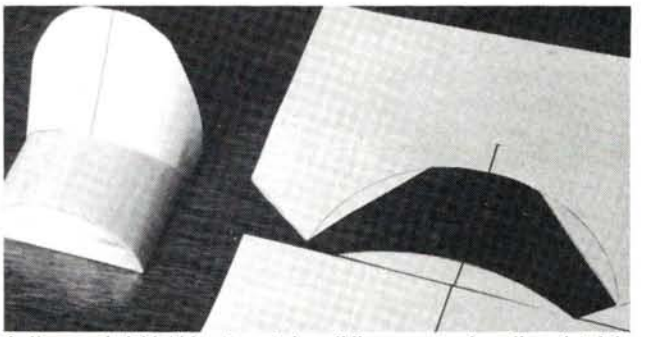
3. Set the compass to provide a radius that's equal to the distance measured in Step 1. Put the pencil of the compass on one of the base-line marks, and put its pivot on the "vertical" line. Draw an arc that connects the two marks as shown.



4. Decide on the windshield's angle of rake (usually, it's about 40 degrees). At both marks, use the protractor to measure and draw lines for this angle up from the base line.



5. Decide on the windshield's height (usually, about half its width). Measure this distance up from the the base line, and mark it on the vertical line. Put the pencil of the compass on this mark and its pivot on the intersection of the two lines. Draw an arc between the "rake-angle" lines. Cut out the shape you've drawn, and you have a template for an open cockpit windshield.



6. If your windshield has to match a sliding canopy, draw lines (at right angles to the rake-angle lines) from where the rake-angle lines intersect the bottom of the arc to the top of the arc. Trim the template along these new lines. Always test-fit your template before you use it to make a windshield.

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1992. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to:
Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

POLKA-DOT SQUADRON

This is Jim Turk's Pica Duelist with Jim's daughter Nicole. Though Jim flies with the Moosejaw Model Club in Moosejaw Saskatchewan, Canada, this photo was taken at the Canadian Armed Forces Base near Baden-Baden, Germany, while Jim was stationed there. Jim says the K&B .40-powered Duelist is "a fine flying model."

MRS. MILES'S ANNIVERSARY

For Shelva Miles of Latonia, KY, this Goldberg Anniversary Cub is a first R/C model project. The Cub is powered by a K&B .65 and guided by a Futaba Conquest FM. All phases of construction were completed by Shelva—right down to the lightning-bolt trim and chrome hub caps. We wish Shelva good luck on her maiden flight and hope she'll send us a few documentary flight shots.

SOMETHING DIFFERENT

Inspired by Andy Lennon design articles in *Model Airplane News,* Dick Schwieren, of Burns, OR, has certainly created something different with this design. Dick's vee-tail incorporates an elliptical wing with a Clark-Y airfoil whose ribs were plotted on his home computer. Specifications: 52-inch wingspan; 439 square inches of wing area with an aspect ratio of 6.2. The tail wheel is buried in the body to reduce drag and is connected to one of the aileron torque rods for steering. A mixing function couples the vee-tail to the ailerons with rudder stick override capability. The Cowl is from a Sig Cougar.

SKYWAY PATROL

California Highway Patrol police proudly pose with Carl Reinisch's 107-inch-wingspan Cessna 180 finished like the full-scale used by the CHP. Carl, who lives in Newbury Park, CA, spent many days at the airport taking photos of the full-scale plane for scale-detail reference. The officers were very supportive of the project. The 77-inch-long Cessna is powered by an O.S. 160 Gemini twin swinging an 18x6 prop. The model's detailing includes a sheriff's badge on the pilot and a Ventura County map in the navigator's hand.

PILOT PROJECTS

ROBIN IN THE CLOUDS

The high hills and low clouds of Chilliwack, B.C., Canada are a perfect setting for Jack Barron's Technopower 7-cylinder radial-powered Ikon N'West Curtis Robin photographed just after its maiden flight. The Robin is covered with Super Coverite that was detailed with Balsa USA pinking tape to simulate rib-stitching. The entire model is finished with polyurethane. The Technopower Big Bore, which is equipped with a McDaniel on-board glow driver, handles the 15-pound Robin at half throttle, is very easy to start and has a sound that can't be beat!

LARGE LIGHTNING

Dick Schwieren of Burns, OR, was so impressed with his friend Marty Snell's scratch-built, 130-inch-span P-38 that he photographed him with the Lockheed and sent us a copy. Construction is of fiberglass and balsa-sheeted foam, and its flying weight is only 28 pounds! The model sports modified Robart retracts and Byron wheels. Dick reports that the big Lightning is very realistic in all flight modes, and the sound of the two Q42s buzzing away only adds to the scale illusion.

ROTO-RULER

Jon Christenson, of Windom, MN, built this twin-rotor autogyro—including the rotor—out of yardsticks, which also account for the 36-inch fuselage length. Jim's flying buddies call it the "Roto-Rooter." The contraption is powered by a Saito FA-40, and its incredibly slow flight speed always attracts a crowd—and also makes it almost crash-proof, as long as you avoid the trees!

6-FOOT-SPAN SPARROW

Alvin Johnson of Oxford, PA, enlarged a free-flight .049-powered design from an April '56 *Model Airplane News* plan to produce this 72-inch-span Supermarine Sparrow. This R/C version is powered by a .40 4-stroke engine and is finished with Coverite and polyurethane. Alvin says flight performance is super realistic.

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

CONSOLIDATED'S FAMOUS FLYING BOAT

LAST FALL, Tom Atwood asked me if I'd care to do a product review of a PBY kit for *Model Airplane News,* and after a lengthy three seconds for consideration, I agreed to accept his offer. Once upon a time, I was a WW II Navy pilot, and since we had a few PBY-5A Catalinas in my squadron, I have flown that plane often. We also had TBFs, SBDs, F4Fs, SNJs, J2Fs and even Martin B-26s (designated JM-1 or JM-2 in the Navy). I admit that

G & P SALES

PBY

SPECIFICATIONS

Wingspan: 81 inches
Length: 51 inches
Power: Two 40-size, 2-stroke engines
Construction: Fiberglass fuselage, foam wing and stab
Weight: 12 pounds

Wing area: 870 square inches
Wing loading: 32 ounces/square foot
No. of channels req'd: 5 (aileron, rudder, elevator, throttle, float retracts); 6, if one on each engine throttle.
Sug. Retail: $269.95 (basic kit); $14.95 (fixed landing gear); $24.95 (videotape).

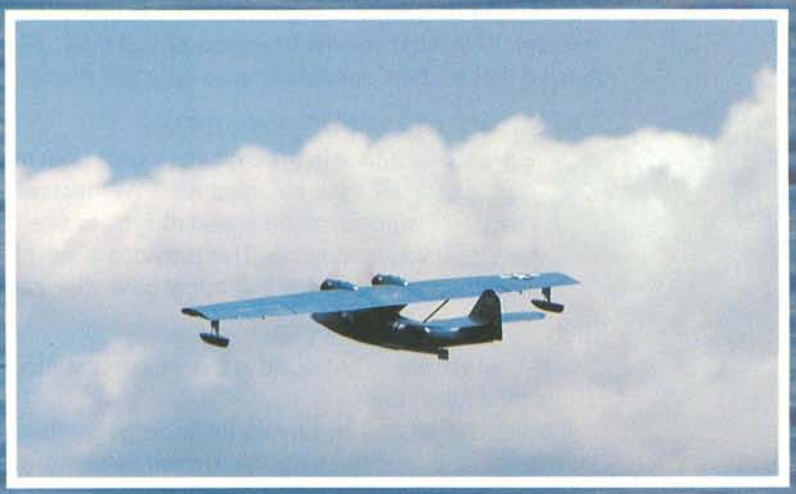
Features: wing-tip floats operated by retracts, high-quality foam parts, gel-coated fuselage, ABS plastic cowls and nacelles. Could be for land operation only—eliminating float retracts.

Hits
- High-quality gel-coated fiberglass fuselage (hull).

by DICK PURDY

flying a PBY isn't the most exciting thing to do when you've also flown fighters, dive bombers, etc., but the Catalina was certainly a reliable and comfortable old bird to fly. I've had my share of exciting moments flying this ponderous amphibian, too, come to think of it!

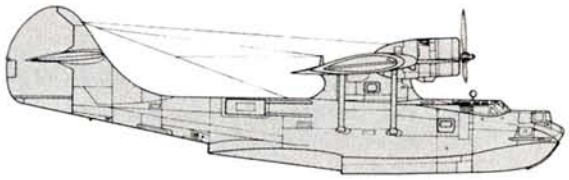
After the discussion with Tom, I received a very large box from G&P Sales* of Angwin, CA. I also received a videotape that was a part of the "package." In the box was a well-protected fiberglass hull; foam wing and stabilizer/elevator parts; ABS plastic nacelles and cowls for the two engines; and clear



- Excellent foam parts for wing and stab.
- Pre-cut plywood and hardwood parts accurately cut, fit well.
- Handles nicely in the air.
- Appearance is quite realistic on water and aloft.
- Optional landing gear (for those without lakes to fly from).
- Informative, optional videotape.

Misses

- Full-size drawings not included in the review kit; wing drawings are now included.
- Manual includes some mistakes.
- Achieving a watertight hull is difficult owing to the removable cockpit section.



plastic vacu-formed parts for the two waist hatch "bubbles" and the front cockpit "greenhouse." Balsa sheeting for the wing and control surfaces was provided, as were other balsa, plywood and hardwood pieces as required. My kit didn't come with the two pre-formed plastic wing-tip floats, but a letter to Bill Price of G&P Sales was all it took to remedy that minor deficiency.

There's nothing surprising about the items that aren't included in the kit; they include fuel tanks and tubing, pneumatic retract units for the wing-tip floats, dummy wheels that are fixed in recessed wells in the hull, engines, all radio gear, adhesives, covering, Nyrods, paint, decals, props, pilot figures and fueler fittings. Except for numerous hand-drawn sketches of various details of construction contained in the manual, my kit contained no plans. However, it's my understanding that all future kits will now include a set of wing plans.

One of the special joys of flying the PBY model is observing it in the air, seeing it on flybys and in the landing mode. The appearance of this plane doing its stuff is simply marvelous.

FLIGHT PERFORMANCE

- **Takeoff and landing**

The PBY stock doesn't handle well in the water. As power is applied, the nose has a tendency to "dig in," causing water to splash up over the bow and into the props. This slows the props dramatically. First flight attempts with three-blade 10x6 props were unsuccessful as the plane could not attain sufficient speed to get up on step. The following four modifications have made it possible to ensure successful takeoffs: extended the splash rail (chine) around the bow; added 2 degrees positive incidence to the engines; used two-blade 9x8 APC props; and increased up-elevator throw to 3/4 inch. The modifications produced acceptable takeoffs using this procedure: with the plane heading into wind, apply full up-elevator and full throttle. The plane will then get up on step, and the props will be free of water spray. Then neutralize elevator and concentrate on keeping the wing level with the ailerons. Let the plane run out about 75 feet, and gradually add slight up-elevator until plane lifts off. Be prepared for a rapid climb-out once the plane becomes airborne.

Landings are a simple matter. Just remember to flare as the plane is close to splashdown, so that the hull section between the step and the water rudder is first to touch down. Otherwise, the plane is likely to bounce and become airborne again, but without enough air speed to fly!

- **High-speed performance**

This plane is fast and goes where you point it. High-speed performance is good and steady, albeit not very scale-like. It took approximately 1/8 inch of down trim to maintain level flight at full throttle. Aileron/rudder mixing at the transmitter was found useful in smoothing out the turns.

- **Low-speed performance**

During the flight tests, we made the plane complete several low, slow passes in front of the dock so that we could take some pictures of it. The airplane slowed to scale-like speed with no problems or bad tendencies. Control response was smooth and positive. The Catalina in a low and slow flyby is truly a sight to behold.

- **Aerobatics**

It's unlikely that anyone would purchase a scale airplane such as the PBY for the purpose of performing aerobatics. We didn't do so, nor do we expect to. However, the video that's available from G&P Sales shows that the plane can do loops and rolls. A purist would consider this to be sacrilegious!

SNEAK PREVIEW

On seeing the videotape and reading the manual of instructions, I showed this material and the kit to my flying buddy, Jim Onorato. Because we both have done float flying frequently, his interest was kindled at once. We struck a deal that he would be a 50-percent partner—my co-builder and test pilot, when the project reached that point. This is one of the best deals I've ever made, since the construction of this kit was fairly complex, and the building experience Jim brought to the project was invaluable. Construction began with the wing. There are excellent polystyrene foam-cores that come in segments, requiring assembly with a plywood main spar and a plywood motor mount bearer along the center section at the leading edge. It becomes clear at an early stage that most of the work involved with this model entails the wing. Since retracts must be installed for the wing-tip floats, channels have to be provided for the pneumatic tubing from the

Vacu-formed clear canopy, nose turret and waist bubbles before trimming.

PBY

center of the wing to each tip. Other channels must be cut out for the two aileron pushrods that also run from the wing center, and two more channels must be cut out for the pushrods for throttle operations.

Further carving of the foam center section is required for the servos that actuate the ailerons and throttles. Careful foam carving is required to cut the ailerons themselves out of the wing panels, and for the recesses that take the mounting brackets for the tip-float mechanisms. Functional wing struts run between the hull sides and the flat underside of the wing. Recesses must be cut in the foam wing for hardwood inserts to which the struts will be anchored. All of this carving is done with a hot wire. The instruction manual provides full-size sketches of each of the required hot wire shapes which, when attached to a soldering gun, gives very nicely formed grooves, and/or recesses.

Dick Purdy and test pilot Jim Onorato making preperations for a "PBY picnic."

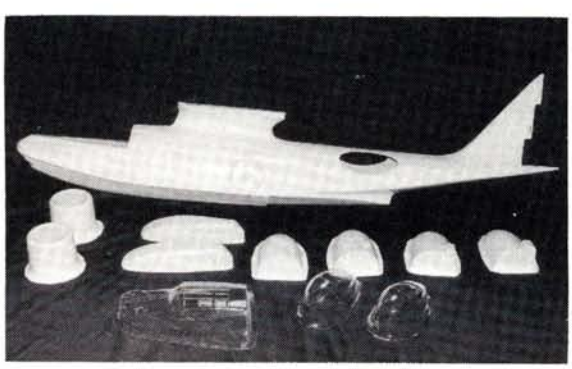
PROP CONSIDERATIONS

During the planning stage of our wing construction, we decided to utilize a pair of the new Irvine* Q-40 engines for our power system. These hummers are endowed with plenty of "oomph," so we agreed to use 10-inch props for them. The G&P design assumes there will be engines of slightly less power, since the space provided for prop clearance would limit the prop size to 9 inches only. The added prop size led us to increase the distance between the engine nacelles by an extra 1 1/4 inches, which, in turn, made it necessary for us to cut out our own plywood firewall to replace that supplied with the kit. Remember that the engines are close together in a PBY—a great benefit when flying on one engine. We don't believe our modifications in this regard will hinder single-engine operation since each engine has been shifted outboard by only 5/8 inch, but we have certainly enhanced the power envelope on take-offs. Those Irvines run exceptionally quietly and have proven to be absolutely reliable.

The instruction manual calls for two throttle servos mounted in recesses cut into the top of the wing. However, with a little judicious planning and layout, we were able to utilize a single servo mounted in a recess in the underside of the wing, directly over the pylon. This was accomplished by placing the aileron servo forward of the main spar, and the throttle servo directly behind the main spar. Flexible-cable run-in sleeves were used to connect the throttle servo to the two engines. This eliminated one servo, but it also let us eliminate any cutouts in the top of the wing, which we felt to be a desirable modification.

When all the tubing, anchors, and pushrod sleeves have been installed in their grooves, and the remaining depressions have been filled with an appropriate spackle, overall sanding is done to prepare for the 1/16-inch-thick sheet-balsa skin. These skins are applied with contact cement, and it's during the skin application that washout is created for the two wing end panels. This step is perhaps the most critical of all fabrication procedures, and it's done to minimize the problems with tip-stalling when in a low-speed mode. Caution is essential at this juncture to keep the upper surface of the wing straight, since there's also a taper in thickness of the wing at the tips that must be reckoned with. This is clearly a two-man job!

Following wing-skin application, both trailing and leading edges of balsa are glued on and sanded as required to the finished shape. It's then that the ailerons are carefully cut out of the wing and contoured to their final form. Balsa edging to receive hinges is added for the ailerons, and after fine sanding, we reached a point where wing-tip retracts and aileron-pushrod installation had been completed, engines had been fitted and fuel mounts and other anchoring points were all in place.



Fiberglass parts, as they come out of the box, include fuselage, tip floats, cowls and nacelle components.

THE FUSELAGE

We turned to the fuselage next. There are various internal hardwood blocks and/or lite-ply parts to be glued inside the hull, such as the mounts for servos, pushrod anchors, wing-strut anchors, main anchor bolts for the wing to the pylon, water-rudder fittings, dummy wheel mounts at the hull recesses, etc. None of these was too difficult to install, but available space for getting your hands inside the hull begins to get pretty restricted. The hull itself is a gel-coated fiberglass beauty, with the two halves joined along the longitudinal center line. This center seam came filled with what appeared to be automotive-type body filler, and the result was smooth and waterproof.

Lots of our attention was given to making the front cockpit area watertight. Since three servos, a Ni-Cd, a radio receiver and a switch all go in the forward section of the fuselage directly under the removable cockpit, it's vitally important to achieve a watertight seal in the hull before installation of the removable cockpit assembly. We finally opted to screw and caulk a Plexiglas sheet onto a plywood mounting plate that was in turn affixed to the hull. The lightweight plastic cockpit form, glued to a 1/8-inch-thick plywood base, is a separate, watertight unit that's then anchored over the Plexiglas.

Since the hull is shaped such that the fin of the rudder is an integral fiberglass part, the stabilizer and elevators, as well as the rudder itself, of course, are attached to this fin. The stab and elevators of this bird are foam-cores with a wooden spar and sheet-balsa skins. Getting the stab glued onto the fin is another time-consuming project because it must be aligned, centered and given an exact angle of incidence, all with respect to the hull's peculiar shape. It's very helpful to build a cradle to hold the hull in a firm, dead-level position for the fitting of the stab and wing, and even later just for storing the completed model.

COVERING

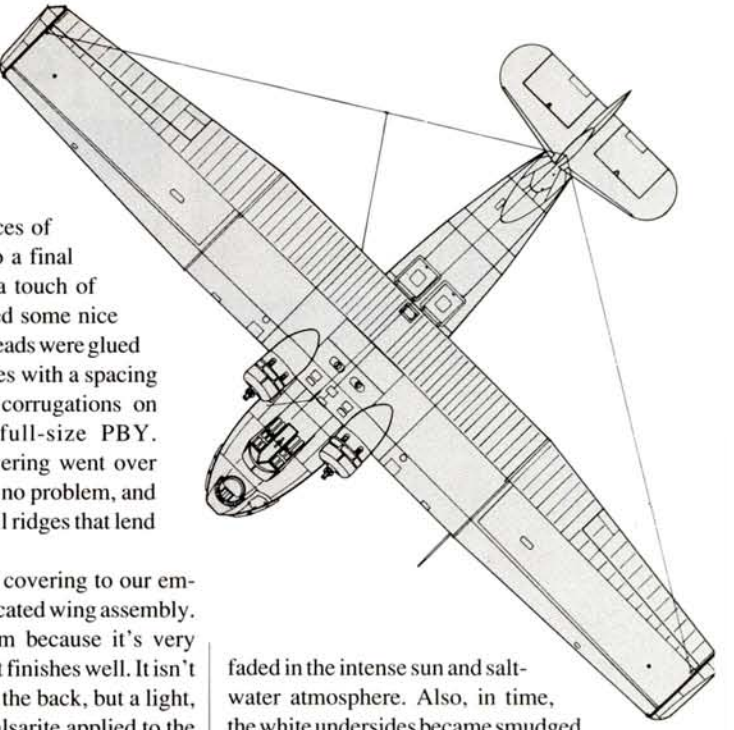
The various control surfaces of our model, now sanded to a final shape, were treated with a touch of individual detail that added some nice character to the model. Threads were glued to the upper and lower faces with a spacing that would simulate the corrugations on those surfaces of the full-size PBY. Coverite's* Micafilm covering went over these threads later on with no problem, and the result is a series of small ridges that lend a realistic corrugation.

It was now time to add covering to our empennage and rather complicated wing assembly. We opted to use Micafilm because it's very strong, light and takes paint finishes well. It isn't supplied with adhesive on the back, but a light, even coat of Coverite's Balsarite applied to the surfaces being covered forms the adhesive bond when heated. There's only a moderate heat shrinkage to Micafilm, so pull out all wrinkles and air bubbles as you iron it on.

With the Micafilm covering done, we were ready to install the two-piece nacelles and cowls for each engine. Du-Bro* fueler fittings were installed in the top of each nacelle for optimum access. By rotating the engine mounts about 70 degrees counterclockwise, the mufflers tuck in under the wing and the needle valves end up very easy to reach near the top of the cowls.

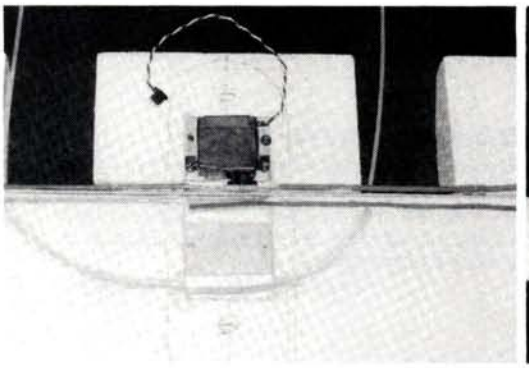
With the engines removed again, we carefully masked the cockpit and waist blisters, and then started spray-painting the bottom of the wing, tail and fuselage. Our choice of paint was two coats of Hobbypoxy* epoxy in a semi-gloss finish, mixed to an off-white for these undersurfaces. After subsequently masking off the white areas, we sprayed on a neutral gray-blue, which matches (to the best of my recollection) the full-scale PBY's upper surfaces.

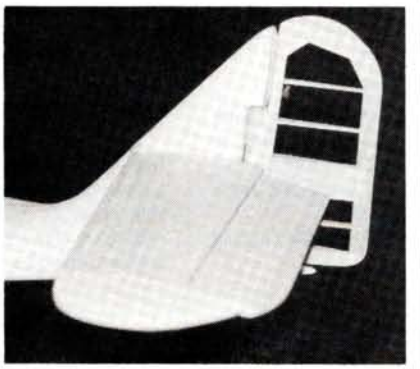
I recall that our planes all were parked out in the blistering hot tropical sun, and the blue color faded in the intense sun and salt-water atmosphere. Also, in time, the white undersides became smudged with oil, exhaust and general wear. Only when our planes went in for a major overhaul was a fresh paint job done.



The last task to be done was the application of decals on wing, fuselage and tail; they always do a lot to dress up any model. With these dress-up features in place, we were ready at last to head for our lake site for the big moment of truth. Unfortunately, winter didn't exit for some time after the completion of our new Catalina model, but we toughed it out for a few weeks, and finally spring came at last.

We checked out the balance of our craft and found that with the receiver, the Ni-Cd and the three servos located as far forward as they could go in the fuselage, the center of gravity was almost right where it should have been without additional weight. Balancing the thrust of both engines by equalizing their rpm was done with care to avoid unequal power and possible yawing. All control throws were checked and set. With the radio and pneumatic retracts performing their assigned roles flawlessly, it was clear that flight time had arrived!





Above: underside of wing showing Nyrod for aileron control, throttle control and air line leading to wing-tip float retracts. Outline is where main pylon wing mount will go. Above right: the entire tail group is mounted on the vertical stab that's molded in as part of the fuselage. Time should be taken when mounting the horizontal stab to ensure proper alignment.

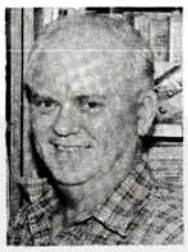
MAIDEN VOYAGE

The necessary flight gear and our beautiful PBY were loaded into Jim's speedboat at the lake here in Connecticut. We also had the company of Jim's brother Rich and one of Jim's sons, Jim Jr., to do still photography and video filming. Then it was off to a small island in the lake, where we set up all the gear, assembled the plane, and got those two Irvine Q-40s purring away. It was a calm but overcast day, and there were no further checks to make, so the plane was gently launched into the water. A little added throttle, and the wonderful sound of those two engines revving up in synch filled the air.

The plane, which weighed 12 pounds, sat a

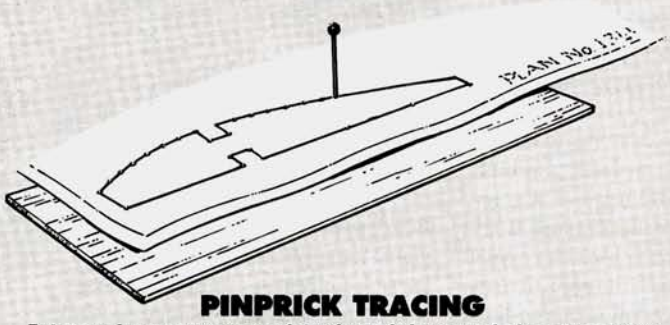
(Continued on page 88)

HINTS & KINKS



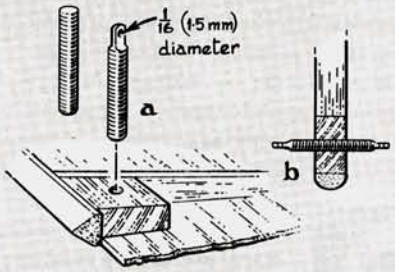
JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



PINPRICK TRACING

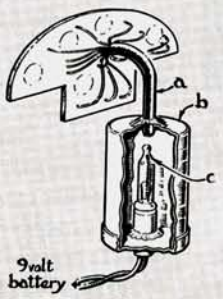
Put your plan over an appropriate piece of sheet wood, then use a pin to prick the outlines of parts into the wood. Remove the plan, and join the pinpricks with X-Acto-knife cuts. ***John T. Collins, N. Adams, MO***



TOUGH CONTROL HORNS

Cut an 8-32 or M3 threaded steel rod to length, and file it to the shape shown (a). Drill a hole for the clevis pin, then screw and glue (use CA) the rod into a hardwood block that will be glued to the control surface. For pull/pull control systems, file both ends of the rod to shape and allow them to protrude from each side of the control surface (b).

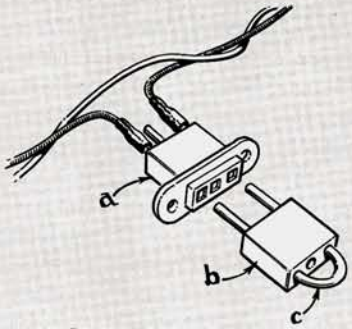
Graham Woods, Birchington, Kent, England



PANEL LIGHTS

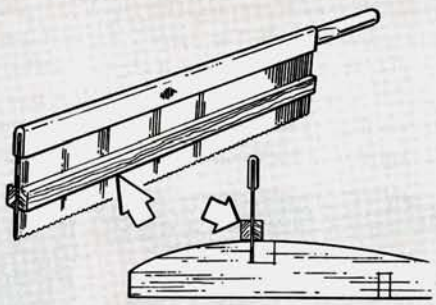
Fiber-optic cable can take light wherever you need it. Cut a piece of it (a) to the appropriate length, and hot-glue it into a black, 35mm film canister (b). Then hot-glue a white or colored Christmas tree light (c) and socket into the canister lid, and wire it to a 9V battery. (The color you choose will depend on what you'd like to see on your instrument panel.) Prick holes through the rear of your plane's instrument panel, then glue each fiber into a pinhole. Turn on the power and you'll have an eye-catching simulation of illuminated instruments and switches.

Wayne T. Herin, Stockton, CA



ON/OFF SHORTING PLUG

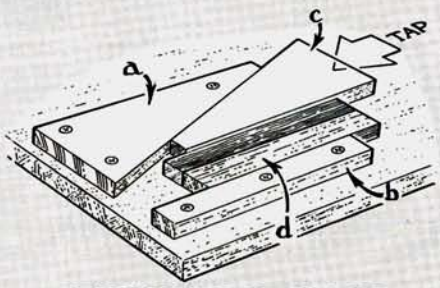
Wherever you want to save weight, e.g., in light models, or when you doubt the reliability of a switch, use this shorting plug to turn your radio on and off. The socket (a) also doubles as a charge socket, while (b) is the shorting plug with a jumper wire (c) soldered across its back. To turn the radio off, remove the shorting plug. ***Garry L. Gaul, Earling, IA***



SPAR-SLOT DEPTH STOP

Use epoxy (not CA) to glue 1/8x1/4-inch spruce-stick stops to each side of a razor-saw blade, as shown. Set the stops according to the depth of your spar material, and the slots will always be the correct depth. To cope with spars of several sizes, why not set up several saws with the stops at different distances from the cutting edge of the saw?

Ronald Breininger Jr., Pittsburg, PA



BENCH WEDGE CLAMP

Cut matching wedges out of 1/2-inch-thick hardwood or aircraft-grade plywood. Screw one wedge (a) and a hardwood strip (b) to your workbench, as shown. To use your new clamp, glue your work pieces together (d), put the assembly against the strip (b), and then tap in the second wedge (c). Before you start, remember to put wax paper under the work pieces to prevent them from being glued to the bench.

Gene Chase, Oshkosh, WI

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

Gentle giant-scale primer

ACE

big BINGO

by RICH URAVITCH

A COUPLE OF things about the origin of the Big Bingo kit are in order. According to their catalogue and my usually reliable sources, Ace R/C Inc.* has been around for 39 years—perhaps longer, if you use the Jack Benny method of chronology. You simply don't survive in a highly competitive marketplace unless you build a reputation for quality, performance and customer satisfaction. It appears that Ace has done so. Their R/C electronics line boasts the only American-made radio-control system still around, as well as a host of chargers, meters, test equipment, accessories and kits.

No less than 11 of Ace's .20 (and up)-powered kits are the result of the design efforts of

D.B. "Doc" Matthews, who has been at this probably longer than he has been practicing dentistry. This Ace/Matthews marriage has produced a series of sport airplanes that range from the 4-20 right up to the subject of this review—the Big Bingo. One look at the Big Bingo makes it easy to trace its lineage back to the 4-20 and even to the 4-120. Move the 4-120's shoulder-mounted wing to the fuselage bottom, add a canopy, enhance the cosmetics, and the Big Bingo is the result. If a basic design works and is widely accepted, stick with it; Doc has, so has Ace, and R/C fliers seem to love it. That's the background music; let's get to the message.

THE BOX ARRIVES...

My first impression upon receiving the kit was that someone had made a horrible mistake. No way could I imagine anything that weighed this much eventually turning out to be an airplane that was anything other than man-carrying. The kit was jam-packed with stacks of die-cut, lite-ply parts sheets, a forest's-worth of hardwood spars, a hefty aluminum landing gear, a canopy and a hardware package that was among the most complete I'd ever seen. The plans, assembly manual and a large set of self-adhesive decorative items were rolled up neatly. After reviewing the plans and the 16-page manual for a couple of leisurely evenings, I began the assembly, using the sequence presented.

THE LIFTING SURFACES

I like Ace's approach to the wings: build them first to get them out of the way. After matching the I.D. sheet drawing with the die-cut, lite-ply sheets, mark each rib with its correct number. There are five different ribs, but the instructions make it easy to identify them. Since you're marking rather than actually assembling at the moment, it's a good idea to mark all of the remaining kit parts. The die-cutting in my kit was excellent, and only a small number of parts required the help of a sharp X-Acto blade.

You're probably beginning to wonder, as I did, why these parts are made of lite-ply rather than the old standby, balsa. Good question! I assume it's because lite-ply is cheaper. The design is certainly rugged enough to have used balsa in many areas; the wing has 10 hardwood spars, a PVC tube leading edge and spar shear webbing! You could use these panels as bench seats during the non-flying season!

Because of their size and design, the wing panels consume a lot of glue. For the statisticians and cost accountants among you, each panel has over 160 glue joints. Since there wasn't a truckload of Zap* available for shipment to my house, and the wood was ideal for conventional adhesives, I used Titebond wood glue for much of the wing construction. Construction moved along quickly, and all the parts fit quite well. My only slowdown came when I had to partially disassemble my fireplace to provide the two bricks shown in the instructions; I used them to hold the PVC leading edge in position for gluing! The final step is to apply polymat cloth to the center-section sheeting on both the upper and lower wing surfaces. This woven material is supplied with the kit and resembles heavy-grade silkspan (you *do* remember that stuff, don't you?). After bonding it to the wood with CA or epoxy, lightly sand it to remove the "frizzies."

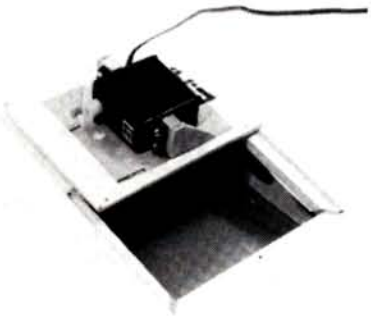
Because of all the prefabrication and the excellent parts fit, you can easily complete both panels in a couple of relaxing evenings.

THE BACK-END PARTS

All of the tail parts—vertical fin, rudder, horizontal stabilizer and elevators—are die-cut from lite-ply. Lightly sand these parts before you apply more polymat cloth to both sides of each die-cut piece to impart additional strength. After

PHOTOS BY RICH URAVITCH

Now here's a radio compartment! Two giant-scale servos and a 1200mAh battery on the right, and an almost-lost receiver on the left. Gives a good indication of the size of the model!



Left: solid bracing arrangement for the tail group. Vertical fin, horizontal stabilizer and fuselage are interconnected by wire, clevises and attachment fittings. All hardware is included in the kit. Right: aileron servos (one per wing panel) are mounted to plywood plates which are then screwed within the cavity in the wing's lower surface. Servo extension leads are required.

SPECIFICATIONS

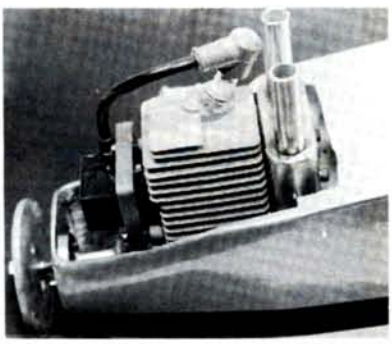
Model name: Big Bingo
Manufacturer: Ace R/C Inc.
Type: Giant-size sport monoplane
Price: $179.95
Wingspan: 85 inches
Wing area: 1,425 square inches
Wing loading: 27.7 ounces per square foot
Weight: 17 pounds, 2 ounces. (274 ounces)
Length: 69.5 inches
No. of channels req'd: 4 (aileron, elevator, rudder, throttle)
Radio used: Futaba Conquest AM, 4-channel with World Engines' servos
Power req'd: 1.08 glow through 2.3ci gas
Engine used: Zenoah G-38 gas
Prop used: JZ 18x8-14 wood
Airfoil type: Semisymmetrical
Washout: None
Wing construction: Conventional built-up, lite-ply and balsa
Kit construction: Same as wing
Features: Tab-lock fuselage construction method; durable T6 formed aluminum landing gear; full-size, well-detailed plans and a complete hardware package.

Hits

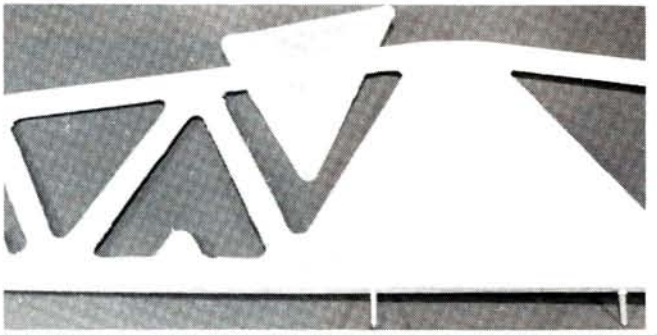
- Excellent die-cutting.
- Well-formed, clear canopy.
- A landing gear that's up to the job!
- Outstanding sport-flying qualities.
- Two-piece wing to facilitate transportation.

Misses

- Assembly manual could use additional photographs.



Left: wheel-pant attachment method. I added a 3-48 screw (arrow) and a blind nut to act as an anti-rotation device. Pants are still in place despite repeated takeoffs and landings on grass fields. Right: close-up of nose shows just how snugly the G-38 fits. Note how the lower portion of firewall was notched and stepped to provide clearance for the custom muffler.



The polymat sandwich. All the tail surfaces are die-cut, lite-ply parts to which you bond a layer of polymat cloth (both sides) before you add the balsa ribs and braces. The polymat cloth is then removed from the holes as shown here. Added strength is claimed.

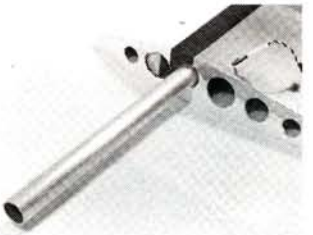
this step has been completed, the lite-ply is framed with balsa ribs, braces and edges. The polymat cloth is then removed from the openings in the die-cut parts. One of Ace's clever touches was to slot the lite-ply surface to accept hinges. When the balsa framing is added, a receptacle is formed

"If you're good with a smaller airplane, the Big Bingo will make you look great; if you're already great, watch out!"

into which the hinge is epoxied. This positions the hinge exactly on the surface's center line. Hard points are incorporated in both the vertical and horizontal surfaces to accept wire-bracing attachment points. All the tail parts should then be sanded and prepped for final covering.

FUSELAGE ASSEMBLY

Before you begin the assembly, you must create each fuselage side by joining the front and rear halves of the die-cut, lite-ply side pieces. The tab-lock or key-lock construction (Ace refers to it both ways) makes this almost foolproof. Additional strength comes



This aluminum tube joins the two wing panels, which are each about 42 inches long. This makes the Bingo easier to transport. An aileron servo extension lead exits the upper wing surface.

from the application of a layer of polymat cloth, which is then followed by a lite-ply doubler. With only seven die-cut formers to install, the fuselage frames up quickly. Any slight warping or twisting in the fuselage side will usually disappear once all the keys, tabs and slots have been properly glued together.

Having the intended engine/mount combination on hand during building will help as it allows you to accurately locate the firewall to suit your specific powerplant.

The upper deck/hatch and the cowl are among the only balsa parts you'll find—a sound choice of material since you must now carve them! With all this out of the way, you've completed virtually all the woodwork.

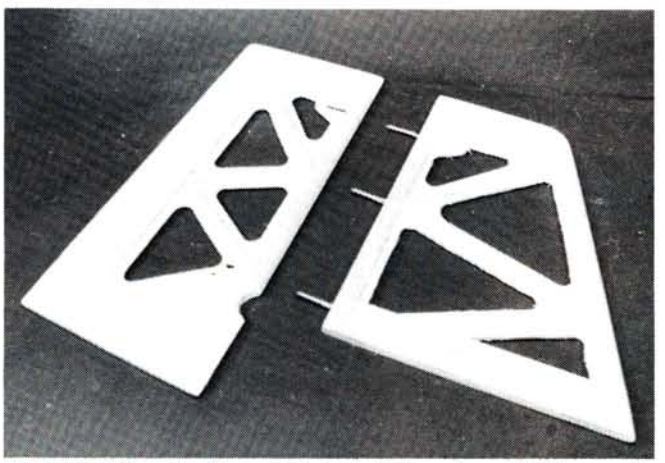
HARDWARE AND INSTALLATION

Temporarily install your engine to facilitate carving the cowl and upper deck to match the 3 1/2-inch spinner; fit the landing gear and tail-wheel assembly and plan your radio installation. In other words, to avoid the risk of ruining a great covering job, install everything, and make all the holes for fuel lines, pushrods and servo leads now, *before* the covering is applied! Now is the time to unite the wing panels with the aluminum tube joiner and drill the four wing-attachment holes through the wing and into the attachment blocks. When all the equipment locations have been laid out, remove the hardware, and prepare the airframe for covering. This means a final sanding, filling the inevitable dings and a final fine sanding followed by a thorough vacuuming to remove all the dust.

COVERING AND DRESS-UP

Since the Big Bingo is a big airplane, and I was concerned about the weight (which proved needless), I decided to cover with film rather than with paint. I chose Top Flite's* MonoKote—the new pearl teal, white and insignia blue for accent. To improve the adhesion of the MonoKote, I brushed a coat of Balsarite* onto both portions of the wing panels that had been covered with the polymat cloth, and onto the PVC pipe leading edge.

(Continued on page 93)



The vertical fin and rudder with the Robart hinges (supplied) temporarily installed. The lite-ply core is notched to accept the hinge with the receptacle formed when the balsa frames are added. A great idea that ensures that the hinges will end up on the surface's center line where they belong!

FLIGHT PERFORMANCE

- **Takeoff and landing**
  The P-factor from the large prop causes some tail swing to the right with the initial application of takeoff power. This is easy to control with the

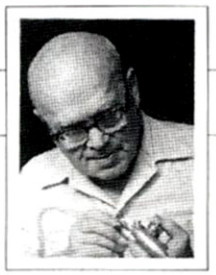
  rudder, which is very effective because of its size. Once the tail is up on the take off roll, the Big Bingo flies with almost no elevator input. Landing into a direct head wind can be almost a three- pointer. Even though the G-38 engine makes it nose-heavy, the model tends to sink predictably during a descent controlled by power. Absolutely no vices here.

- **High-speed performance**
  The G-38-powered B2 moves along at a brisk pace at full throttle with no power-trim changes evident. It's definitely *not* underpowered. Pulling hard turns doesn't appear to cause any appreciable loss of energy or flying speed.

- **Low-speed performance**
  This model could bring new meaning to the term "low-speed stability"! It's about as gentle a sport airplane as you could ever want. You can easily reduce its forward motion to zero just by balancing the throttle and elevator inputs; from this mode, simultaneous application of just the right input will allow the Bingo to drop its tail and hang on the prop. This model will give you the confidence to try new stunts that require the use of all four channels.

- **Aerobatics**
  The Big Bingo is *not* a pattern contender. It's at its best doing what most of us spend the better portion of our flying time doing—sport flying. Set up with the recommended control-surface throws, it performs a nice roll that requires only a bit of elevator correction; a touch of down-elevator makes inverted flight almost simple if your confidence level is up to it. And stall turns?—with the size of that rudder, they happen right now if initiated slightly early while in the vertical. If you could move the rudder full left to full right fast enough, I bet the Bingo would respond fish-like and add a few mph to its speed!

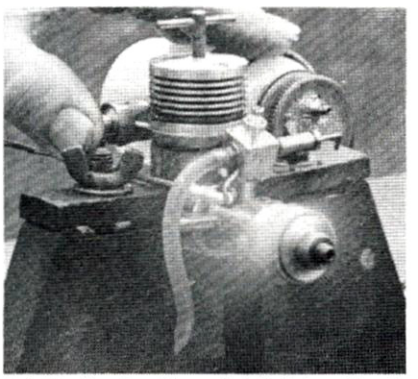
About Those Engines



JOE WAGNER

MORE ON DIESELS

MY RECENT COLUMN on model diesel engines brought in more readers' mail than anything else I've written about here in years. American modelers seem eager to find out what the Europeans have known since 1946: miniature "diesel" motors have a lot of advantages!



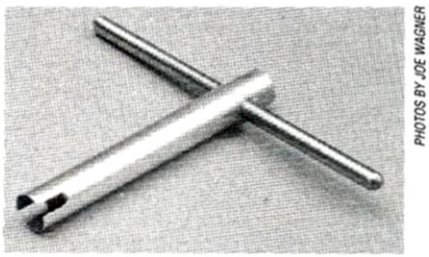
P.A.W. diesels will run indefinitely with substantial amounts of back pressure.

One of my readers has accused me of being a "shill" for P.A.W.'s* engines. I have no connection with that firm—or any other model company, for that matter. But I've enjoyed such excellent results from my own P.A.W. engines, I can't help sharing my high enthusiasm for them.

Progress Aero Works (which is what P.A.W. stands for) makes an extensive line of miniature diesel engines. Their displacements range from .049 to .60; all are available with or without R/C carbs. Both plain and ball-bearing versions of most engines are also available, and P.A.W. will even supply "competition-tuned" versions (at extra cost) of many of these. All in all, the complete P.A.W. line includes over four dozen sizes and types.

Two features of P.A.W. engines particularly appeal to me. One is their easy operation; the other is the minuscule size of their mufflers. Mounting a P.A.W. in the nose of a cowled R/C airplane involves less trouble than with any other muffled model engines I know of, because a P.A.W. muffler barely protrudes past the edge of its engine mount.

I made an amazing discovery with my own P.A.W. diesels. They are extremely tolerant to back-pressure. I can close off their muffler outlets almost completely—and they'll keep right on running! The rpm drop somewhat, but the sound level decreases tremendously. My P.A.W. .19, spinning a 9x5 prop with the throttle wide open, puts out 91dBA, measured on the exhaust outlet side, one meter away. With the exhaust covered, only allowing leakage past my thumb, the sound drops to 73dBA—not much louder than normal conversation level.



PHOTOS BY JOE WAGNER

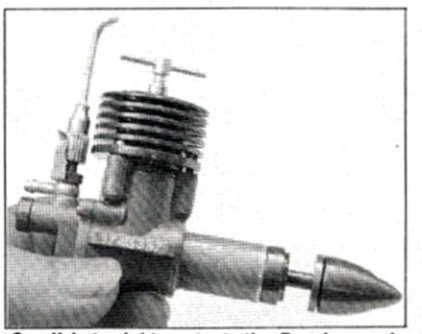
For adjusting compression in cowled-in diesels, this "tommybar twister" is easily made from brass tube and steel wire.

The engine gets slightly hotter than usual when I try this, but I can still hold the exhaust opening closed with my bare fingertip without undue discomfort. That means the muffler temperature can't be much over 130 degrees. This also means that this engine will probably function well with those long exhaust tubes we usually avoid with glow engines

MK-17

I've just acquired a truly exceptional model diesel:a Russian-made MK-17. Though all single-cylinder, 2-stroke model engines have design elements in common, this little .09 has several quite unusual features. For one thing, the MK-17 is the first small engine with rear-disk rotary induction I've seen in quite a while. Many high-performance American model engines in the '40s and '50s used rear rotors, notably the record-breaking McCoy "Redhead." And the MK-17 is a "redhead" too!

This engine's crankshaft runs in twin ball bearings—and "instrument grade" rather than "industrial." The needle-valve assembly is another surprise, a true variable-orifice type, with a "positionable banjo" fitting. The engine comes with two interchangeable venturi inserts; one for high speed and the other for sport flying. I had no problems whatsoever hand-starting my MK-17 with the "racing" venturi in place, and this little Russian gem runs as smoothly as any model diesel I've ever seen in action.



Small but mighty potent, the Russian-made MK-17 is meticulously built, easy to hand-start, and runs well with both big and small props.

The MK-17 does lack two features that have become almost necessities for R/C flying: a muffler and a throttle. Adding a home-installed carb shouldn't be too hard a job, but I don't believe an add-on muffler will be quite so easy with the MK-17. Also, this engine seems quite sensitive to back pressure.

But for its price (around $50 as of early 1992), the MK-17 diesel's a genuine bargain in high-performance, high-precision miniature diesel motors. Carlson Engine Imports* carries these, as well as many other intriguing model engines. Their catalogue costs only a dollar and lists almost 150 different model diesel, glow, and CO_2 engines from all over the world.

because of overheating problems.

One common misconception about model diesels is that high compression produces the most power. That's definitely not true! Once the engine starts, its internal temperature quickly rises. This adds to the "compression effect" and induces pre-ignition. That's why your model diesel will develop its best power if, after it begins running, you back off its compression-adjustment screw a bit.

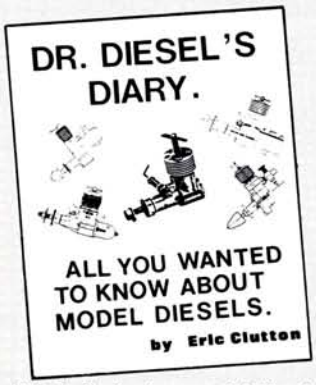
The color of a model diesel's exhaust residue is an excellent clue to its proper compression setting. The darker, the higher; a light brown indicates optimum compression for most R/C powering purposes—and the longest life for the motor!

**Here are the addresses that are relevant to this article:*
***P.A.W. USA**, 913 Cedar Ln., Tullahoma, TN 37388.*
***Carlson Engine Imports**, 814 E. Marconi Ave., Phoenix, AZ 85022*
***FHS Supply Inc.**, Box 9, Bethel Church Rd., Clover, SC 29710.*
***Eric Clutton**, 913 Cedar Ln., Tullahoma, TN 37388.*
***K&S Engineering**, 6917 W. 59th St., Chicago, IL 60638.* ■

QUESTIONS & ANSWERS

I always appreciate readers' input, and I respond to every letter I receive (please include an SASE, though). I do my very best to answer all the questions thoroughly and accurately— even if it takes several pages. Sometimes, the questions are of general interest and can be answered briefly; I'll respond to such queries in "Questions and Answers." Please send your model engine queries to me at 251 Danbury Rd., Wilton, CT 06897, not to the Mount Morris, IL, subscriber office!

I've received 35 letters (so far!) from readers asking various questions about model diesel engines. I've replied to each query, though most involved the same basic subjects: fuel formulas and diesel operating techniques.



This is the book on model diesel engines. Its subtitle is no exaggeration: everything is covered, and in simple language.

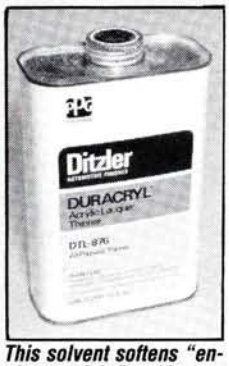
Although the "recipe" for model diesel fuel is simple—approximately 1/3 each kerosene, ether, and castor oil—I don't recommend home-blending it. The ether is tremendously volatile and flammable. It's far safer to buy your diesel fuel ready to use—and you'll be sure of the consistency and purity of the ingredients. FHS* sells top-quality diesel fuel mail order; I use nothing else.

As for the operating techniques for diesels, they're not difficult. The whole procedure—including troubleshooting—is explained in simple and straightforward terms in Eric Clutton's book "Dr. Diesel's Diary."* If you want to fly with diesel power, you have to have this!

Wally Steinberg writes from Gary, IN: "I can't find Sunbeam "Metal Klean"—the solvent you recommended for removing baked-on varnish from model engines. Where can I get it?"

The Sunbeam product was discontinued a couple of years ago. But I've found another solvent that works almost as well for removing the dark-brown castor oil "varnish" from glow-engine heads. Ditzler "Duracryl" acrylic lacquer thinner will soften "engine varnish" enough for you to rub it away. However, this solvent is slow-acting. It takes time and some hard scrubbing to remove a heavy, baked-on residue. One the other hand, Ditzler's product is far safer to use than "Metal Klean." That was extremely caustic and required working with rubber—not plastic!—gloves.

Three Cox reed-valvers with customized tank vents. Note the Kustom Kraftsmanship* back cover on the Pee Wee .020—it's well worth using!



This solvent softens "engine varnish," and is non-caustic. Be sure to use it only in a well-ventilated area, however.

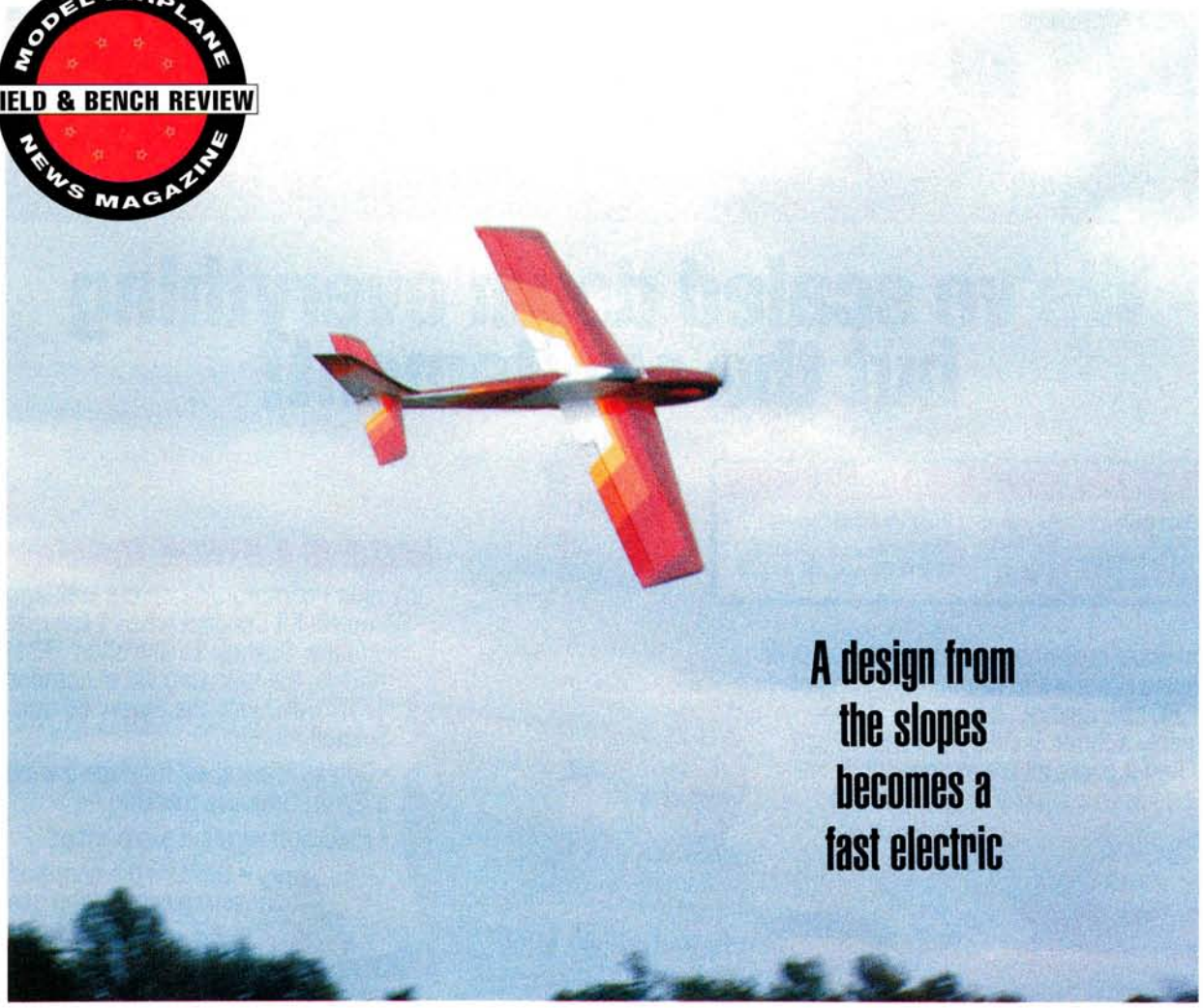
Otey Howe (St. James, MN) asked for a method of making fuel tubing stay on Cox reed-valve fuel tank vents.

The best all-around solution I know of is to replace the tiny Cox vent tubes with larger ones. Here's how: with a hand chuck or a pin vise, grip the outer end of the existing tubes (Black Widow or Dragonfly type) and gently but firmly twist and pull them out.

Next, sweat-solder a 1/4-inch length of 1/8-inch o.d. K&S* brass tube over one end of a length of 3/32-inch tubing. Cut off the assembly at the right length to fit the tank. Deburr the ends, then (with the hand chuck again) slowly twist and press the new brass-tube vent into place where the old one was. Repeat for the other vent. The new 1/8-inch ends will hold standard plastic fuel tubing firmly.

A Dragonfly tank requires a little more work. Fill the molded plastic vent alongside one mounting screw hole with epoxy. Replace the single aluminum tubing vent (described above) and install another vertical vent in a 3/32-inch hole drilled in the tank's bottom wall. You'll end up with the same style of tank venting as the Black Widow has. (Bend the upper vent slightly to keep it clear of the needle valve.)

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW



A design from the slopes becomes a fast electric

DOUGLAS AIRCRAFT

ELECTRIC BREEZE

BY BILL GRIGGS

DOUGLAS AIRCRAFT* produces several successful high-performance, slope-soaring ships. The Electric Breeze—an electric version of the Quick Silver aerobatic slope soarer—is this company's first entry into the world of electric flight. Converting a sloper to electric is a good move because the things that make a sloper groove (e.g., a low-drag, aerobatic design) also make for a sporty electric ship.

The slippery SD6060 airfoil carries weight well (batteries or ballast), and it flies well inverted or upright. The white foam-core, balsa-sheeted wing is strong and can be built quickly. The long tail moment creates a very stable flying plane with a fast, flat glide, and the generous control-surface areas contribute to a responsiveness seldom seen in electric planes. When you add a hot cobalt motor to this mixture, you get a plane with lots of "wow" to the ounce.

THE KIT

The majority of the wooden parts and hardware are wrapped in plastic and either taped or stapled to the kit box to prevent damage during shipping. The foam-cores are securely held in place by a card-

Three-year-old Danielle Griggs with her father's Breeze.

Don Belfort (left) and author Bill Griggs check out the Breeze before the next flight.

board divider. A lot of planning went into the packing of this kit.

The quality of the wood is above average. The 1/16-inch balsa sheeting for the wing is light and straight-grained. The fuselage sides are machine cut, as are all the wooden pieces in the kit.

The Breeze comes with most of the hardware included. I substituted Sig* Easy Hinges for the ones supplied simply because I like them. The kit doesn't provide a list of needed hardware. This slowed down the building of the fuselage while I went to get the necessary pushrods. The 20-page instruction book includes 19 black-and-white photos. To avoid CA fumes, I used thick and thin UFO* CA throughout.

CONSTRUCTION

Before you start building, read all of the instructions so that you have an overview of the project. I framed-up the Electric Breeze in a little over 20 hours, and I spent an additional 14 hours on the covering.

"The Electric Breeze delivers everything it promises in performance. The quality of the kit is well above average..."

FUSELAGE

The fuselage is a basic box construction with 1/32-inch plywood doublers and several pieces of triangle stock (to permit rounding of the corners where the fuselage sides meet the top and bottom). The 1/32-inch ply doubler extends back past the wing saddle and adds a good deal of stiffness to the fuselage.

The pushrod cable housings are installed before the fuselage sides are joined. To align the pushrod with the control horn, a small wedge is glued beneath the pushrod tube near the elevator.

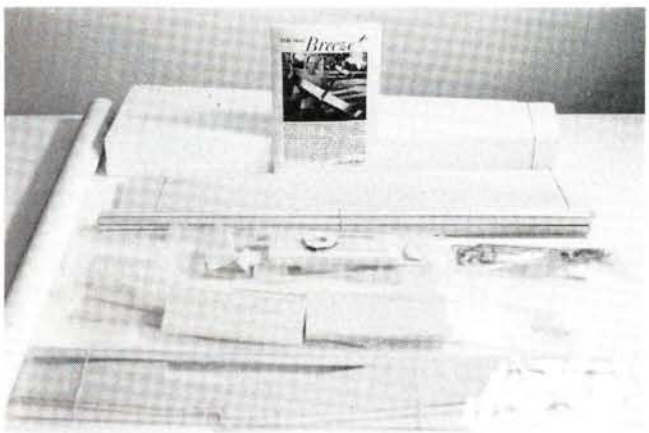
PUSHROD CABLE NOTE

At this point, I need to jump ahead in the story. I received one of the first 12 kits produced. The early instructions called for Sullivan* no. 507 cable pushrods, and the review plane was originally built with these cables. On the first flight, the elevator fluttered while in a level, flat-out pass. The horizontal stab and rudder parted company and were held on only by the clevis. Luckily, the plane hit flat, and no additional damage was done other than a broken prop. This plane is strong!

I replaced the cable with Sullivan no. 508 cable in under an hour without having to cut into the fuselage. It works fine, and I've experienced no more flutter. The directions in subsequent kit runs call for this cable, which eliminates the problem.

BATTERY SPACING

Install the bulkheads, and join the two fuse sides; then sheet the top and bottom of the fuselage.



The kit features rolled plans and machine-cut parts in individual packets.

Step 12 in the instruction book is split between two pages. The plans tell you to use a 1200mAh pack as a spacer when sheeting

SPECIFICATIONS

Model name: Electric Breeze
Type: Aerobatic electric
Price: $79.95
Wingspan: 52 inches
Wing area: 362 square inches
Wing loading: 16 to 19 ounces per square foot (depending on battery selection)
Weight: 41 ounces with SR 1100mAh Max cells and 3 S-133 servos
Length: 37 inches
No. of channels req'd: 3 or 4 (aileron, elevator, throttle and optional rudder)
Radio used: Futaba Attack E with MCR-4A receiver/speed controller and S133 servos; Futaba Super 7 with Graupner MOS 30 speed controller
Power required: 05 motor (ferrite or cobalt)
Battery: 7-cell Ni-Cd (900, 1100, 1400, 1700mAh tested)
Prop used: APC 7x6
Airfoil: SD6060 semisymmetrical
Wing construction: balsa-sheeted foam-core with spruce leading and trailing edges.
Fuselage construction: balsa, ply and spruce
Features: the kit features all machine-cut parts individually packaged and stapled to the box to prevent damage during shipping. Excellent quality foam-cores and balsa parts lets you build this ship quickly and accurately.

Hits

- Flat, extended glides accent a highly aerobatic ship.
- The quality of the balsa is excellent.
- It's light and strong, and you can build it quickly. The wing mount is designed to shear, not break.
- It's good looking.

Misses

- The recommended elevator throws were excessive and resulted in over-sensitivity in the pitch axis. (The specified elevator horn has only one clevis mount; modification or a programmable radio is needed to reduce throws.)
- The aileron servo is permanently attached as designed, but this can be easily remedied by adding a hatch.

FLIGHT PERFORMANCE

- **Takeoff and landing**

Hand-launching is recommended because the optional landing gear doesn't include a steerable tail wheel. Landing gear is recommended only for landing on paved runways. The Electric Breeze takes to the air with authority and climbs fast. If you flair the landing, the wing will usually start flying again, and you'll tend to overshoot the runway. The Breeze shows no tendency to drop a wing during landing. Landings should be made with the wings level with little or no flair.

- **High-speed performance**

The Electric Breeze is capable of astonishing speeds. It has a very fast cruise speed, and when it's put into a power dive, the plane really moves out. The Breeze has a deceptive habit of continually accelerating in level flight. The performance is such that only experienced pilots should consider it.

- **Low-speed performance**

There's no such thing! The Breeze doesn't bleed off speed easily. It's such a clean design that the wing doesn't want to stop flying. The plane has no bad slow-flight tendencies.

- **Aerobatics**

With the Astro Cobalt 05 FAI motor and seven 1100mAh Max cells from SR* batteries, the Electric Breeze is capable of most aerobatics. Rolls require very little down-elevator input. Loops are large, round and graceful. The Breeze has a very fast left snap roll, but it's slower while it snaps to the right. The plane spins well, with exits occurring shortly after releasing the controls to neutral. The plane as reviewed will perform a large outside loop, but only from a slight dive.

The Electric Breeze is a very sleek, fast, aerobatic electric model that can perform aggressive, full-bore stunting. The plane is very stable and predictable, and it will do exactly what you tell it to do. The Breeze is also quite strong, as shown by its ability to withstand some hard landings.

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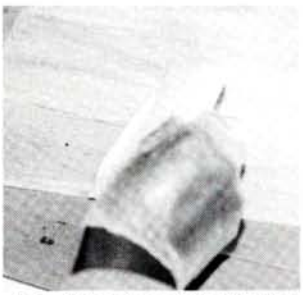
the top. Since I didn't read the second half of the step until I had already started sheeting the top, it was difficult to fit the 1200mAh batteries into the fuselage later on—a good example of why it's important to read all of the instructions in advance.

The 1/32-inch plywood doublers have holes die-cut in them to allow cobalt motor brushes to stick through into the air scoops. These holes aren't necessarily in the right spot for all motors, so you may need to adjust them to suit your installation.



Here, I chose to vacu-bag the wing and, therefore, used epoxy to attach the skins. Any excess epoxy must be removed from the skins.

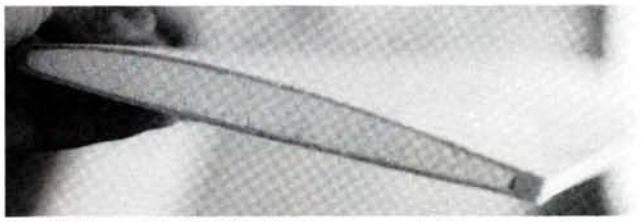
SHEETING THE WINGS

The wing on the Breeze is constructed of white foam-core that's sheeted with 1/16-inch balsa and a spruce leading-edge and trailing-edge cap.

First, fill any imperfections with Model Magic* filler. When the filler has dried, sand the cores with fine-grit sandpaper on a block; then vacuum the dust off the cores. This may seem like a lot of preparation, but the results are excellent.

Glue the balsa sub leading and trailing edges to the core with 5-minute epoxy, and tape them into place while the glue sets. Next, sand the leading and trailing edges to the shape shown on the plans. To protect the foam while you sand the balsa edges, place a strip of masking tape on the foam along the length of the core next to the leading and trailing edges. Now you're ready to join the six 1/16x4-inch wing sheets to form the skins.

I laminated the balsa skins to the foam-core in a vacu-bag with



The thin lines of the SD6060 airfoil can be seen in this wing panel that was fresh out of the vacu-bag.

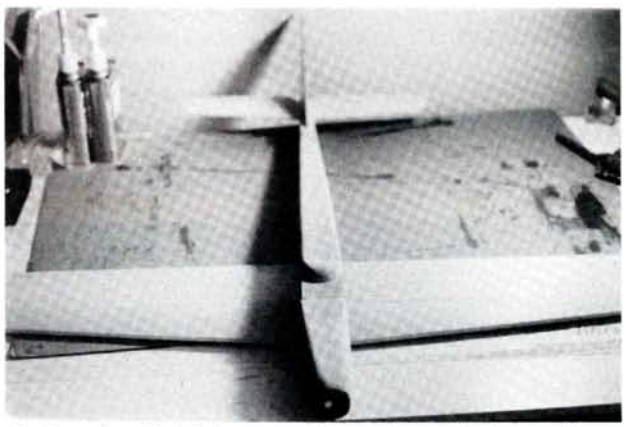
E-Z LAM* laminating epoxy—the method I prefer. If you use contact cement and weights, which also work well, keep the following tips in mind:

- To give yourself a margin of error, cut your wing-skin sheets slightly larger than the outside dimensions of the cores.
- Follow the directions for the contact adhesive that you choose.
- Two adhesives that work well are 3M double-sided adhesive tape and Dave Brown's* Sorghum. The 3M tape, which is available at most art-supply stores, is applied to the skins and leaves only an adhesive residue when the backing is removed.
- If you use epoxy, which is one of the heaviest adhesives, remember to apply it to the skins sparingly with a squeegee. Don't apply it directly to the foam-cores.
- With contact cement, use a sheet of wax paper between the core and sheeting to prevent premature bonding. This allows the skin to be positioned carefully and gives you a little more control over the whole process. Remove the wax paper; then rub the sheeting into place.
- Put the wings back in the saddles, place a board over them, and weight it down until the adhesive has set. (I normally use two car batteries.) The remainder of the wing construction is fairly straightforward, and you can build the stabilizers while you wait for the cores to dry.

STABILIZERS

I installed the optional rudder because I wanted full aerobatic capability. I simply cut the rudder to the mark indicated on the plans, sanded a bevel on the LE of the rudder and hinged it with a Sig's Easy Hinge.

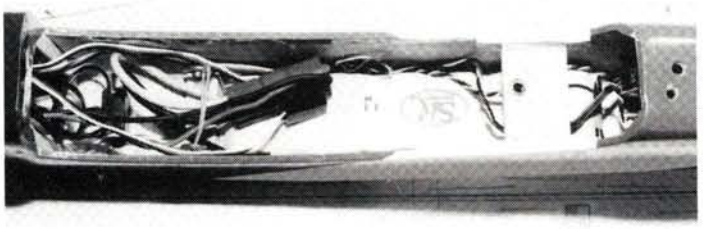
The horizontal stab LE and TE are 1/8-inch-square spruce and are sanded to shape after they've been glued into place.



The framed-up Electric Breeze awaits covering and final assembly.

The elevator halves are joined by a piece of 1/16-inch music wire. You must make a brass control horn for this wire and solder it into place. The last page of the instructions recommends that you use a longer control horn if your control throws are too large. I found the recom-

mended control throws to be overly sensitive; the review plane could be flown with elevator trim alone! Part of the problem can be solved by using a larger plate when making the control horn. But since the horn sits inside the back of the fuselage, it's best to make any change before installing the elevator.



The wing mount on the Breeze is well designed. Balsa plates on either side of the fuselage ensure that, in a crash, the balsa will shear off with the wing intact.

Using the Futaba* Attack electric system (with the MCR-4A receiver/speed controller) with S133 servos, I found that there was a practical limit to how well I could tone down the ship's responsiveness with mechanical adjustments. (I didn't wish to replace the elevator horn.) I swapped the Attack for a Futaba Super 7 radio (coupled with a Graupner* MOS 30 speed controller), and I used dual rates to reduce the throw. Dual rates or endpoint adjustments can make the Breeze much more manageable in the air.

FAIRING

The wing fairing is the last item to be constructed. Once the radio gear has been installed, the fairing is glued over the aileron servo onto the wing. This makes it impossible to adjust the linkage after assembly, and it seals the servo in the plane. I modified the fairing to include a removable plywood plate. The wing bolt passes through the plate and the fairing.

AIRBORNE INSTALLATION

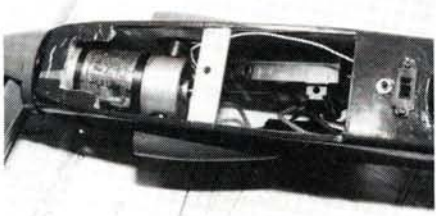
Most of the radio installation can be done before the plane is covered. I installed the aileron servo first so the fit with the fairing could be established before the fuselage was covered. The elevator and the rudder servos were installed behind the wing saddle with servo tape. Douglas Aircraft now recommends that you do the same. There's plenty of room for the Futaba S-133 servos, although connecting the pushrods isn't easy. The flight batteries were held in place with Velcro® to the roof of the compartment. I covered the model with MonoKote*.

FINAL ASSEMBLY

After the plane has been covered, install the wing hold-down plate and fairing. Next, glue on the horizontal stab, and make sure it's aligned with the wing. Glue on the rudder and the fin, install the control horn and connect the surfaces, and install the motor and the battery. My plane balanced right on the mark, between 3 and 3 1/2 inches back from the front of the wing saddle. The battery pack could be moved to adjust the CG.

CONCLUSION

The Breeze is a high-performance aerobatic electric plane. As such, it isn't recommended for novice pilots. However, anyone who could handle an Electro Streak could probably handle this plane.



Power is provided by an Astro Cobalt 05 FAI and APC* 7x6 prop. A Futaba MCR-4A receiver/speed controller is located behind the motor. Cooling air is provided by the cheek-cowl air scoops.*

Because the plane has such a thin airfoil and the lines are so clean, this plane doesn't want to stop flying. Many times, I've set up for a landing and then breezed across the field at shoulder height. This isn't a plane you can dive in for a landing because it retains its energy well.

The Electric Breeze delivers everything it promises in performance. The quality of the kit is well above average, and it's reasonably priced. I'd definitely build another one!

**Here are the addresses of the companies mentioned in this article:*

***Douglas Aircraft Model Aviation,** P.O. Box 92472, Long Beach, CA 90809.*

***Sig Mfg. Co.,** 401 S. Front St., Montezuma, IA 50171.*

***UFO;** distributed by Satellite City, P.O. Box 836, Simi, CA 93062.*

***Sullivan Products,** P.O. Box 5166, Baltimore, MD 21224.*

***Model Magic;** distributed by Carl Goldberg Models, 4732 West Chicago Ave., Chicago, IL 60651.*

***E-Z LAM;** distributed by Aerospace Composite Products, P.O. Box 16621, Irvine, CA 92714.*

***Dave Brown Products,** 4560 Layhigh Rd., Hamilton, OH 45013.*

***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.*

***Graupner;** distributed by Hobby Lobby Int'l., 5614 Franklin Pike Cir., Brentwood, TN 37027.*

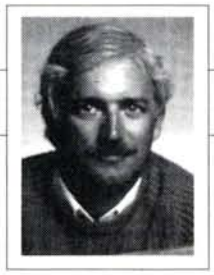
***MonoKote/Great Planes Model Distributors,** P.O. Box 9021, Champaign, IL 61826.*

***SR Batteries Inc.,** P.O. Box 287, Bellport, NY 11731.*

***Astro Flight Inc.,** 13311 Beach Ave, Marina Del Rey. CA 90292/*

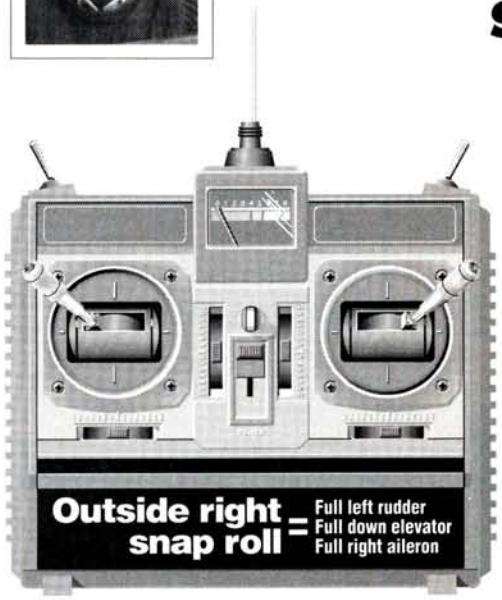
***APC/Landing Products,** P.O. Box 938, Knights Landing, CA 95645.* ■

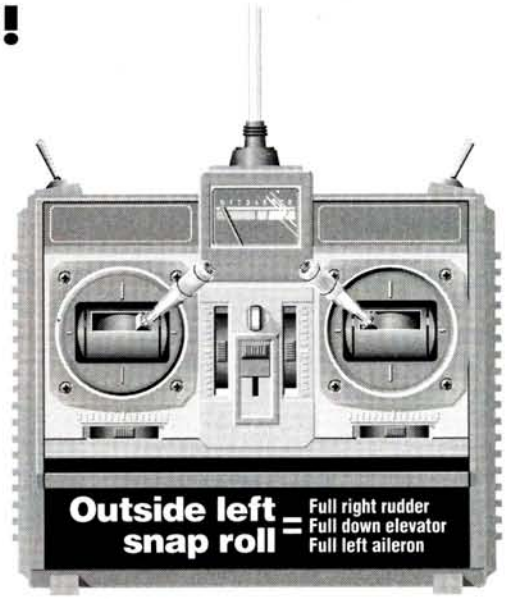
AEROBATICS MADE EASY



DAVE PATRICK

SNAP ROLLS!





LAST MONTH, I covered how to do spins; this month I'm going to discuss snap rolls, which in many ways are very similar. In fact, I like to describe a snap roll as a high-speed spin. Like the spin, there are interesting variations that can be quite challenging and fun to do.

THE CONTROVERSY

What is a snap roll? It seems to be different things to different people. In fact, I've seen experienced, well-intended judges differ strongly at major competitions on what constitutes a proper snap roll. Since it happens so quickly, it's also difficult to observe.

In this pilot's opinion, a snap roll is a slick roll that's initiated by stalling the aircraft, which then autorotates quickly. (It isn't a high-speed roll with some elevator and rudder in it.) Here are the criteria for a true snap roll:

- There's an increased angle of attack during the maneuver.
- Rotation is quicker than is possible with ailerons alone.
- There's a significant speed loss.

Here's the problem for the judges: since rotation is so quick, it can be difficult to observe the pitch angle. Only the pilot really knows how fast the plane can roll with ailerons. Without an air-speed indicator, it takes a keen observer to note the difference in air speed. To make matters worse for the judge, the modern pattern ship has thinner wings that stall at an even lower angle of attack, making the snap roll even harder to see.

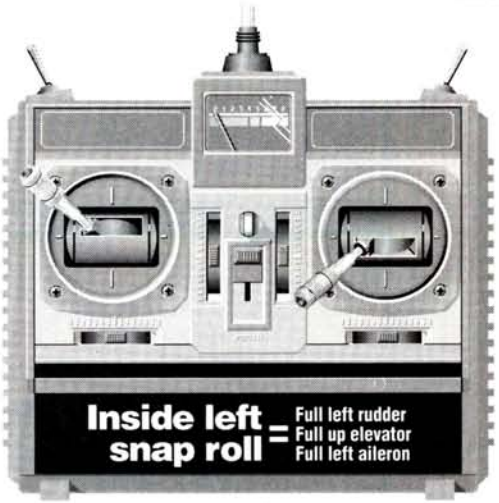
THE RIGHT PLANE

Please don't try to do snap rolls with the wrong airplane, such as an electric glider. It probably won't perform a snap roll and, worse yet, you could break the wings because of the high load. Depending on entry speed, you can expect to load your plane's wings with three to as many as 10 Gs, and possibly more! So be careful! Strong aerobatic aircraft are best-suited to snap rolls. Remember, use the right tool for the job.

STALLED AGAIN

As in the case of the spin, your airplane must first stall before it can snap-roll. The key is understanding that a stall occurs when a wing achieves a certain angle of attack, not a given air speed. Thus, you can perform snap rolls at different entry speeds, as long as you achieve the stall angle with the wing. To achieve that high angle of attack, you have to "load" the wing by adding a pitch input.

For example, if you're flying straight and level, and you quickly apply up-elevator, the main wing's angle of attack will increase dramatically. Some aircraft may snap-roll at this point without any additional urging. If you think about it, the faster you're going, the harder it will be to stall and, of course, the more stress you'll put on those wings. Also, note that I said "quickly apply up-elevator." Good, fast servos are the order of the day if you want



to perform the best snap rolls. I like to use a high-quality coreless servo, such as the Futaba* 131-S or a 9201 on all flight surfaces, and I use a five-cell battery pack. (Please check radio manufacturers before trying five cells, as some servos can't handle the extra voltage.)

THE FIRST SNAP

If your aircraft is set up as described in last month's column, and it can spin, chances are, it will easily snap. If not, it may need some more throw in all controls, and/or some more tail weight. Please go very easy on these adjustments, as they can dramatically affect flight characteristics.

Now you're ready for your first snap. Climb to "a-couple-of-mistakes high" or to about 200 feet, and then throttle back to about one-third power, and let your air speed diminish to about three-quarters of full flying speed. Now, this is where nerve comes into play. From a level or slightly nose-high altitude, very quickly apply full up-elevator, full aileron and rudder simultaneously and in the same direction. Hold for about one-half to about three-quarters of the roll (or about one-half to three-quarters of a second), then neutralize. Observe the position of the plane, and recover.

If your plane performed a tighter, faster roll than it could with ailerons alone, and you could see a positive pitch angle during the rotation, you have just performed a snap roll! On the other hand, if your plane did a high-speed barrel roll and rotated at approximately the same speed as an aileron-only roll, then you need to try a lower entry speed and/or more throw and a more aft CG position (just as we did for spins).

THE RIGHT SPEED

Remember, we're trying to stall the aircraft, then have it autorotate. At low speed, this is quite easy to do, plus it's easier on the wings. As entry speeds increase, however, the stress on the wing increases dramatically. The good news is that when you enter at a higher speed, there's more flying speed when you recover and, hence, more control. So, you have to make a decision: what speed is best for your skill level and your aircraft?

AND NOW, FOR MY NEXT TRICK

Let's look at some variations on this theme. We've just learned to do inside snap rolls. Once you're comfortable and can consistently perform this maneuver, try these:

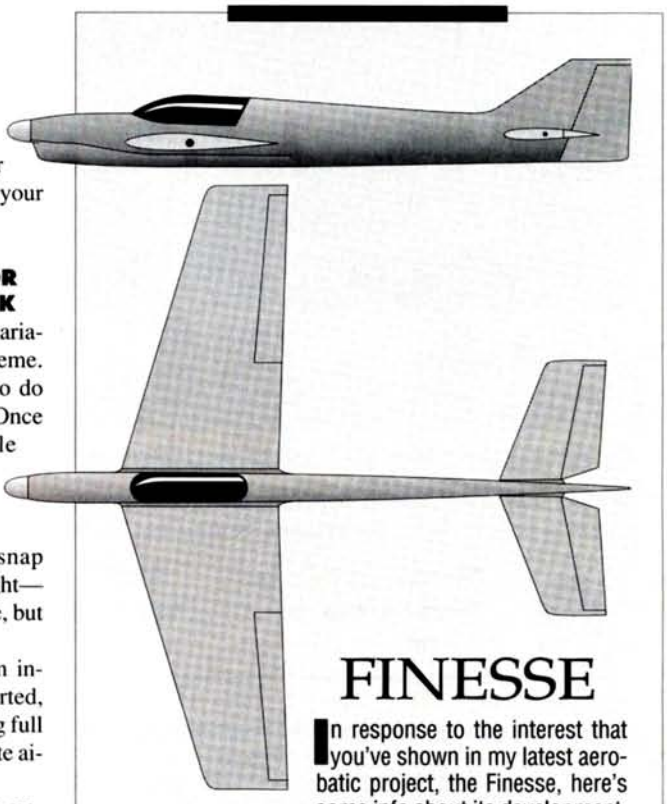
- One-and-a-half snap rolls to inverted flight—simply snap as before, but recover a bit later.
- Outside snap from inverted—roll to inverted, then snap by inputting full down and full opposite aileron and rudder.
- Outside snap from upright—give full down and full opposite aileron and rudder. There can be a significant altitude loss, so start at a safe height.
- Knife-edge snap—roll to knife-edge flight, and snap in the direction in which you have the rudder deflected to maintain knife-edge. For example, roll 90 degrees right, then add left rudder to hold knife-edge. Now, snap by giving full up-elevator, full left aileron and full left rudder. To recover, neutralize all controls, then quickly add left rudder to regain knife-edge flight.

SNAP SWITCHES

Many of the top radios have "snap switches" that permit you to perform a snap roll simply by hitting a toggle. While I've seen some fliers use them quite successfully, I prefer not to use them. I manually "fly" through the snap roll. I like to be able to lead into the maneuver by applying the pitch command just ahead of yaw and roll and to recover by releasing pitch just before yaw and roll. This doesn't add up to a large difference, but it's a little cleaner with less heading loss.

I hope this took some of the mystery out of the snap roll. Like all maneuvers, it takes some practice to perfect. This is especially true with the snap roll because timing plays a big part in getting it right. Till next month...

**Here's the address of the company mentioned in this article:*
***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.*



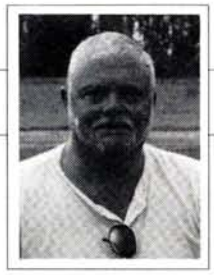
ILLUSTRATIONS BY JONATHAN T. KLEIN

FINESSE

In response to the interest that you've shown in my latest aerobatic project, the Finesse, here's some info about its development.

Conceived on the flight back from the FAI World Championships in Australia, the Finesse combines features of its predecessor, the Conquest, and of some of the designs that were flown in Australia. The Finesse is a large, light aircraft with a thin airfoil, a plug-in swept wing and stab and a removable canopy and belly pan. It will be powered by a modern 1.20 (such as the YS). Its flight tests have gone better than expected, and I'll be flying it at future competitions with no modifications. If you'd like to fly the Finesse, a kit will be available from R/C City, 96 Railroad Ave. #F, Suisun, CA 94585.

SPORTY SCALE TECHNIQUES



FRANK TIANO

TOP GUN TALK

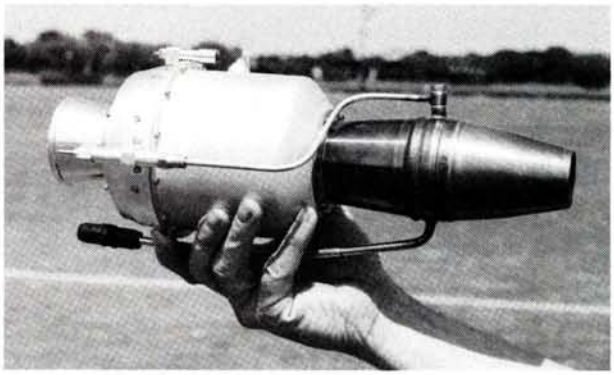
RUMORS HURT

IF THERE'S ANYTHING that torques me up tighter than finding a 3-inch misplaced CG 15 seconds into a maiden flight, it's hearing a rumor, so blown out of proportion and context, and I'm defenseless to do anything about it! So, I thought I'd start this month's column by setting the record straight on a subject you may find rather interesting.

By now, almost everyone interested in Top Gun has heard something about an incident in which a model aircraft hit the roof peak of one of the dwellings surrounding Top Gun Field. Two days after the event, a colleague from the West Coast called with his condolences because he had heard that Top Gun would probably come to an end because of this tragic accident, one where the model penetrated the special 2-inch-thick, Florida-style roofing shingles, and proceeded to slam through an attic floor and injure some poor slob who was watching a basketball game in his living room, another entire floor below! *Not!* C'mon guys, give us a break.

Flying a plane that's backlit by the morning sun is absolutely no problem if you're wearing a pair of Zurich glasses. Everyone's response could be summed up in one word—"unbelievable!"

The true story was that Richard Crapp lost his transmitter battery shortly after takeoff with his beautiful Russian AN-2 biplane and, indeed, did hit the rooftop. However, no people reside in this house at this time of year in Florida, and while the model received a severe, unscheduled, nose job, damage to the roof was minimal. In fact, the damage amounted to a couple of cracked tiles. The total bill for these damages was $155, including tax, which the Top Gun Committee paid promptly.



A great shot showing the Turborec T240 turbine's size. The jet flew at Top Gun and is available from JPX, Zone industrielle nord, 72 320-Vibraye, France.

The point of all this is really very simple. When something out of the ordinary happens in our hobby, there always seem to be a select few who just must be the first to spread the bad news. Something like those special relatives who must be the first to let other family members know that a loved one has passed away. Well, the trouble with this, in our case, is that these rumors are allowed to spread and usually grow more grotesque with each telling. Often, a person *not* interested in aeromodeling will overhear one of these tall tales and come to a conclusion something like, "That there model aeroplane flying must be real dangerous, I sure don't want none of those maniacs flying around my neighborhood!"

So, in a heartbeat, a simple, harmless incident has become a major catastrophe and has set us back years in our efforts to promote our sport. Next time, listen for the facts, check them out and be absolutely positive what really happened before spreading a rumor that indicates otherwise. The flying field you help save may be your own!

The year of the Cat? Still another Bearcat—this one from Helge Carsen*, who's kitting it for the Scandinavian market. It weighs 28 pounds, and has an 88-inch span for 3ci gas engines. All the way from Norway.

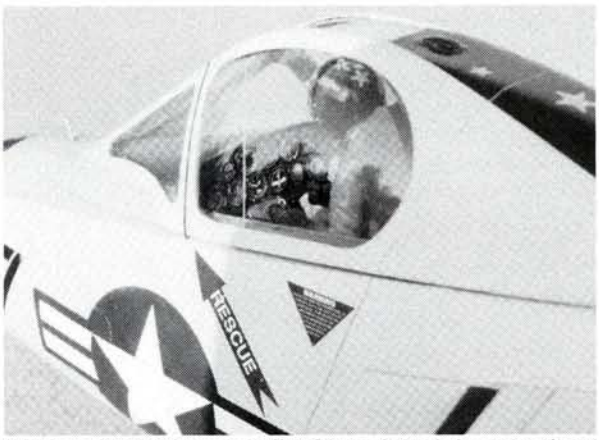
SUPER SHADES

At Top Gun, I became aware of a product that not only interested me, but became very useful as well. To make a long story short, that hot, glaring Florida sun was playing havoc with my eyesight during the morning rounds. Boyd Newman* came to my rescue with the absolute *best* pair of sunglasses I've ever worn, and let me tell ya, I've worn plenty. These "Zurich" sunglasses filter out so much of the harmful rays that if you're flying near the sun, you can still see your airplane. Talk about safe! So, you're not gonna get a commercial for Zurich sunglasses out of Mr. Sporty Scale this month. What you are going to get is

Corvin Miller shows how he duplicates the top canopy hatch on his Globe Swift. Check out the pilot holding on to the wheel. Nice hinges!

an honest suggestion that each and every reader of this column take a moment to think about how valuable your eyesight is and how important it is to be able to see our aircraft at certain times of the day. With that in mind, call Boyd and order a pair of these great, protective, sunglasses. Yes, they come in lots of colors and yes, they even fit over your regular prescription eyewear. Sixty bucks and worth every dime!

Jerry Caudle's award winning BVM F-16C shows what a neat pilot can do in a shallow cockpit. The heads-up display is worth another look.



Have a peek at Mark Frankel's F4D Skyray. Lots of glass area almost demands a nice interior and, of course, a pilot. Mark's instruments are flawless!

INTERIOR THOUGHTS

We'll close this month with still another suggestion, and some questions and answers. This one should be enjoyable, interesting, rewarding and fun to execute: on your very next scale project, why not make it a point to spend 25 percent more time and effort on your cockpit interior than you did on your last model. This means if your last plane didn't even have an interior, you'll have to add something this time. If you made a half-hearted effort on your interior last time, put a little more into it this time. If you went almost full-blown last time, go the extra mile this time, and make it perfect. If you made it perfect last time, carefully rip out the entire cockpit interior, mail it to me and make yourself a new one! Just kidding.

More and more models are showing up at the field without a pilot and not even a resemblance of a dashboard or instrument panel. You might be surprised at how much realism these two items can add, and you might also need lessons on how to react to all those compliments you'll receive. Remember, scale modelers are counterfeiters. Our goal is to make things look as real as possible. All it takes is some time, a few scraps of plastic and wood, a little paint and some ingenuity. Try it, I think you'll find the results quite rewarding.

This is the Big Mama that hit a roof at Top Gun and lost. Richard Crapp's AN-2 was one of the most impressive biplanes we've ever seen.

Q&A

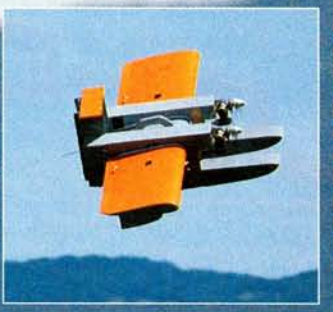
Q. *What's the most common cause for a large, 2-stroke engine not to run correctly?*

A. This is easy. It boils down to two things—fuel and prop size. Most of the problems encountered with a balky engine can be prevented if you read the instructions that come in the box. The newer, large 2-strokes, such as the Super Tigre 2500 series, require less oil than we're used to running. These beasts run best on 10 percent oil. If, however, you run an Irvine engine, you'll need more oil—up to 20 percent—than the usual 16 to 18 percent that's in our commercial fuels. It's all a matter of reading what the manufacturer writes in the instructions.

In the prop-size category, if you're running a prop that's too small and you overrev the engine, you'll fall past the horsepower curve and you won't get the power that's available from your engine. If you swing a prop that's too large, that big hunk of wood will load your engine down too much, and all you'll get is an overheated engine. This, too, can be avoided by reading the instructions and using the prop size that the guy who built the engine wants you to use.

(Continued on page 100)

No, this isn't an optical illusion; it's Willie Gardner's ST2500-powered 96-inch "Mad Max!" It features a pod fuse, twin booms with dual-operating empennages and 48-inch Sullivan floats extended to 54 inches. The scratch-built creation flies beautifully! Sorry, no plans.



Look closely! Gary Stanton mated two fuselage/pylon-float combos to a 60-inch wing to create this twin beast. The 12-pound, ST .40-powered creation flies well, and it's guided by a Futaba 8-channel radio.

CLEARLAKE

One of the best just keeps getting better

by JOHN SULLIVAN

THE CLEARLAKE meet has been around for a long time. My first experience with this event was—if my memory serves me—in the late '70s. At the time, it was held in conjunction with a float fly for full-scale floatplanes that was organized by the U.S. Seaplane Pilots Association, and only Clearlake club members (and a few others by chance word of mouth) were privy to announcements for it. Attendance was low, and the R/C flying was informal and somewhat "dicey" owing to all those $100,000 full-scale seaplanes that were either tied up at the docks or making low passes 50 feet off shore. I remember watching an ultralight on Lotus floats fly alongside a .60-powered Ugly Stick for a couple of hundred yards. Simultaneously—without any communication between them—the planes "peeled off" in opposite directions, and I wondered, "Could something weird happen here?" Fortunately, nothing terrible, or even mildly

PHOTOS BY JOHN SULLIVAN

Joe Zimmerman's prototype Spectra II 4-place amphibian is about as sleek as floatplanes get. This 80-inch, 12-pound craft will go through a weight-loss program before being kitted. An Enya Rizo provides the power. (For info on the kit, contact Joe at 2925 Golf Rd., Turlock, CA 95380.)

A ¼-scale L4 climbs out at Clearlake. (Sorry, I didn't get the pilot's name.)

Howard Chapman and friends hover around Howard's Seamaster 120. The OPS Maxi 30 sports a Reichmuth ignition, and the original stab has been converted to an all-flying stabilator.

1992

Gary Stanton and Ryan Bandy concentrate as Gary calls for Ryan's Ugly Stick .60 on floats. He flies it with a Futaba 4-channel radio.

Bob Venon's striking Morrisey Bravo taxis back to the ramp after a satisfying flight. The Bravo has extended, built-up Sig floats. Note the stationary fins on the aft float decks.

Below: builder J. Paul Lussier (left) and Mike Amerson demonstrate the size of J. Paul's incredible ½-scale Sopwith Tabloid. The 52-pound giant is currently being "re-powered" by a hopped-up 5.8ci Quadra 100 that will swing a 28x6 prop. Right: Mike Amerson's .91 O.S. Surpass-powered Ace Bingo dips a wing on a low flyby. With 36-inch Sullivan floats, it weighs in at 7¾ pounds.

Background photo: George Gissendanner's Marquardt Charger during a flyby. Note the Konocti Mountains in the background.

Paul Lockwood fires up the O.S. 120 twin on his Great Planes Corben Ace with 40-inch Sullivan floats. The weather at this year's event was perfect—sunny skies and reasonable water conditions.

Dennis Grady of San Andreas, CA, tweaks the Enya R120 on his restored, 8-foot Unionville Beaver with Sig floats. It was originally built by his friend, the late Frank Easton.

life-threatening, ever happened.

In time, the number of models began to exceed the number of full-scale ships, and something had to give. Dick Hershey, Wally Rinker, Bill Gresham and the late Mo Curry put their heads together and decided to hold a separate float fly for models at a new site—Library Park in Lakeport, CA. They approached the Clearlake Modelers (a land-based club with its own strip on a hunting ranch) and the Lakeport City Council. Providing they could obtain the necessary permits, their plan was approved, and the Clearlake Float Fly was born. Mother's Day weekend in Lakeport hasn't been the same since!

(Continued on page 71)

(Continued from page 67)

This is just part of the pit area at the one-block-square Library Park in Lakeport, CA, site of the annual Clearlake float fly.

ANTICIPATION

Before each year's meet, I feel both excitement and wrenching anxiety. The excitement comes from remembering all the good times past; the anxiety comes from wondering whether something this good can go on forever. Will the weather erupt and blow every model to shore like driftwood? In an age where liability comes before God and country, will the powers that be "just say no"? Will an entrepreneur decide to hold a new trade show 50 miles away on the same weekend? Not to worry. With each passing year, Clearlake has grown in size and stature.

This year, 151 pilots registered almost 300 planes, and they made literally thousands of flights. (It's also important to note that the 55 Clearlake club members aren't allowed to participate; they have to work!) There were some minor problems: those who arrived with their motor homes early in the week expected free spaces in the city-owned mobile-home lot. After some negotiating, the courtesy was extended to the days preceding the meet but, next year, all campers may be required to pay the modest fee. In addition, the Will-O-Point Resort, which is located adjacent to the flying site, was locked up in a legal hassle until just days before the meet, but it opened just in time to take on the overflow.

Patt Foster and Dan Nalley of Stream Inc. came from Tacoma, WA, to join the other exhibitors at Clearlake. The floatplane is Stream's low-wing intermediate trainer—the Aquasport 90.

AT THE MEET

The weather was great—an important factor when high winds can turn your "runway" into a heaving seaway. Just over the mountains, a half an hour away, there was enough wind to snap trees and topple power lines, but Clearlake miraculously escaped this "blow." Each day, the water was calm in the morning, and then it became choppy around noon and developed some swells later in the afternoon.

The Clearlake group streamlined the call-up and frequency procedures, mostly by limiting the time they gave pilots to respond, and I didn't hear anyone complain about not being able to fly. As an example, Mike Amerson, a young pilot from the Napa Valley area, flew six times on Friday and five times on Saturday. On Sunday, he threw in the towel and pitted for his stepdad, Frank.

This year, there were more exhibitor booths and greater club participation, including a contingent of Schneider representatives (the Burton brothers, who came all the way from Lake Havasu, AZ, Ian McInnes, Roy Slater, J. Paul Lussier and Richard Lucas). Many pilots brought their families, and the picnic tables, swimming areas and park playgrounds were always full

I saw only one "frequency" incident. On Saturday, Bruce Estes' ship was hit, and it started to head inland. Bruce regained control just in time to turn—with very little airspeed—and land unceremoniously behind the docks. It was a fantastic save without any apparent damage!

SCALE TREND

Although no official count was made, I estimated that 40 percent of the models were scale, and most of them displayed excellent craftsmanship. This is a far cry from just a few years ago, when many of the seaplanes were simply converted land planes that had seen extensive service. In fact, I've noticed a trend: many of the modelers (from this region, at least) built their planes specifically for this meet! Of course, many of the ships have been flown at other sites, but the idea of introducing them at Clearlake is there.

The event featured all the traditional amenities. The Lakeport Volunteer Fire Department offered a fine breakfast at the adjacent yacht club, and hundreds took the advantage of the opportunity to eat and watch the boats bob in the harbor before each day's flying began. Wally Rinker spared us his traditional, amplified, 7:00 a.m. Tarzan-imitation wake-up call, and no one complained. He did, however, try it later one day, but was partially drowned out by the sound of seven planes in the air.

The ever-attentive chase-boat crew was on the spot every time. They quickly (and carefully) returned down or out aircraft, and they chased pleasure boats and jet skis out of restricted areas.

The grand-prize drawing included a Seamaster 120 with a Zenoah G23 and a 7-channel radio and another combo for second place. In addition, more than 100 items were given away in a raffle on Sunday afternoon. These included a Swenson Specialties Beast kit and one of Bill Price's .40-powered PBY kits.

The Clearlake Modelers never fail to wear everyone out. When the raffle was over, all concerned were ready to go home. Too much fun? Probably, but there doesn't seem to be anyone bold enough to suggest backing off even a notch! Besides, we all have a year to recuperate!

Bill Price of G&P Sales syncs the twin .60s on his latest kit offering—a 10-foot version of the PBY Catalina. The scale retractable tip floats and the landing gear work flawlessly.

Special thanks go to the Clearlake Modelers for staging one heck of an event. Clearlake has become one of the finest R/C flying showcases in the U.S., and I know that I speak for everyone when I say that the efforts of the Clearlake club would be very hard to match and are very much appreciated.

SIMPLE PROGRAMMING

DAVID C. BARON

SERVO OUTPUT TRICKS

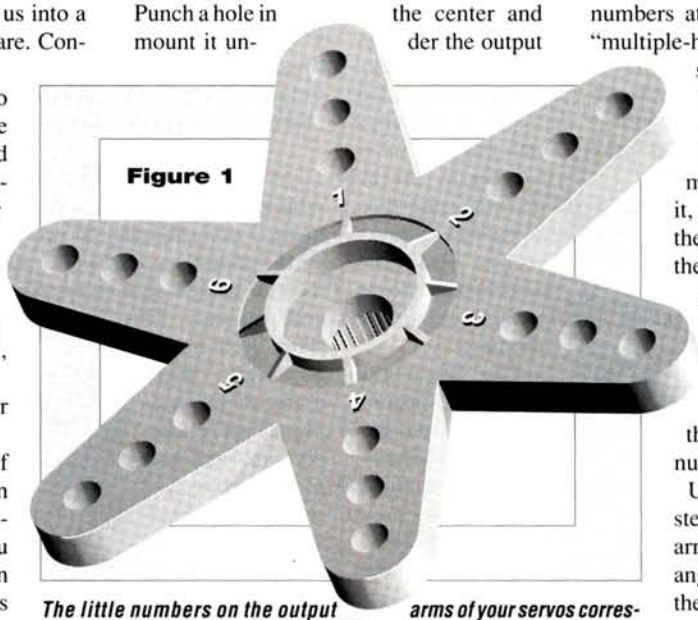
BEFORE THE ERA of computer radios, limited mixing and servo-travel adjustments were set by switches, and the range of throw was set on potentiometers. Because servos left the factory set at their maximum throw settings, we were able to use these switches to compress servo travel. While these abilities were considered wonderful at the time, they've led many of us into a trap of which you may be unaware. Consider these questions:

- Have you ever used dual rates to tame an aircraft that was sensitive in the pitch, roll or yaw axis, and then not readjusted the linkage connections at your control horns or servo-output arms at the end of a flying session?
- Have you ever used your adjustable travel volumes to reduce control-surface travel in pitch, roll, or yaw?
- Has an aircraft of yours ever experienced flutter?

If you answered yes to either of the first two questions, you've been sacrificing servo power (and precision) for convenience. If you answered yes to the third question (and your pushrods and linkages aren't suffering from slop), then aerodynamic forces may be overpowering your servos.

With the advent of programmable radios, you can control servo-travel expansion as well as reduction, i.e., you can use all the potential power and efficiency of your servo's full range of travel. A servo that drives a control surface a total of 45 degrees while traveling through its full 120 degrees of motion will exert a more precise and powerful force on the control surface than a servo that's restricted to 60 degrees of motion to move the same surface the same 45 degrees. The gear drive of a servo that moves through 120 degrees, by comparison, spreads the load out across the servo's full range of travel.

Most servos have the mechanical ability to travel through 120 degrees of throw. (The only exception that I am aware of is the Airtronics systems that are designed to allow only 90 degrees of motion.) Every time that we restrict (or compress) our servo's throw, we are giving up chunks of information that represent lost motion. Test your own setup by making a paper protractor that is graduated into 15 degree sections. Punch a hole in the center and mount it under the output arm of your servo. Are you using the full 45 or 60 degrees available in each direction? If you aren't, the motion you are not using could be increasing power and precision on your control surface.



The little numbers on the output arms of your servos correspond to how many degrees of offset the arms will be from an arbitrary starting point on the output spline (see text). The spline is the notched shaft on which the servo wheel or multi-point arm is mounted. Manually adjust the output wheel/arm so that the arm to which the pushrod is attached is perpendicular to the length of the pushrod. This is better than changing the centering with your transmitter.

I'm not suggesting that all modelers are cutting down the throws that drastically, but did you know that two of the major manufacturers are keeping 33 percent of the servo's travel and power in reserve? You may not have noticed because of the way the information is presented in the manuals and on the transmitter's information screen! All this lost motion and power can be released from the transmitter.

SETTING UP

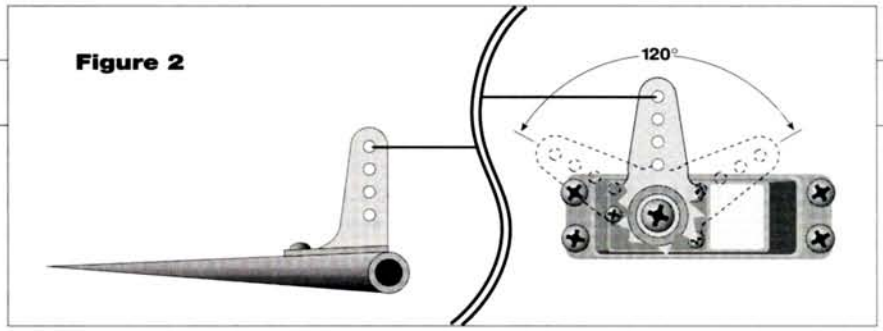
To use your servo throws to maximum advantage, you must install your airborne system with great care. Your servos may be moving a lot farther than they ever did before. The output arms of the servos must be carefully set so that they're perpendicular to the control rods. Remember that the numbers at the base of the arms on the "multiple-horn" servo-output arms correspond to degrees from zero. Thus, if you rotate the servo wheel or multi-point output arm on the servo spline, i.e., by removing, rotating and reinstalling it, to find a position where one of the arms most closely approaches the desired position, you'll find that each servo arm will be positioned slightly differently with respect to your control rod. These differences are matters of a few degrees, and those degrees are specified by the numbers on the arms.

Use this mechanical method, instead of any electronic method, to arrive at a perfect perpendicular angle to your pushrod. This way, the radio is left at zero with an equal amount of electronic signal for each direction of servo throw. To take advantage of maximum servo travel, you'll also need to use the large control horns on your control surfaces, but this will only increase the precision and efficiency of your installation.

NEED TO RESET SERVO CENTERS?

Any programmed offset either side of a servo's center affects the total travel to either extreme when you are using all of the travel available. To guarantee your servos are centered, you may want to use the reset function whether you're modifying a previously used program or starting from scratch. It's also a good idea to use your transmitter to reset the servo centers to zero if you've used any of the following functions that affect servo centering:

Figure 2



Full motion of the servo will drive the control surface with the greatest precision and power. The outermost hole on the control horn should be used to extract the smoothest control. If there's too much throw, move the pushrod to an inner hole on the servo's control arm to desensitize the linkage.

• "Trim memory" or "sub trims" (Futaba*)
• "Sub trim" or "Trim offset adjustment"(JR*)
• "Electronic surface centering" (Airtronics*)

HOW MUCH THROW?

Most of the manufacturers use travel-volume extremes that exceed 100 percent. This has always seemed a little odd to me because I don't expect that there could be a range beyond 100 percent. The manufacturers are really describing incremental points of travel throw as percentages. To my knowledge, only Airtronics uses 100 percent to represent maximum servo throw. This is in their Infinity and Vision series of radios using their "ATRCS" system. Here are some observations that may be of interest if you own one of these major brands of computerized radio.

ALL RADIO SYSTEMS

When manipulating servo travel, remember that each side of neutral must be adjusted separately. If you adjust one side, remember to change the other as well. This may not be of paramount importance on the elevator channel, but it could be critical with the ailerons!

FUTABA

Futaba radios vary depending on the model. They all have the feature ATV (adjustable travel volume), but they'll either have a range of 0 to 110 percent or 0 to 120 percent on either side of neutral. All of the Futaba radios start at 100 percent when new, or if reset. One of the additional features in the 9VAP radio is AFR (adjustable function rate). This feature is specifically designed for those of us who use heavily mixed radios, and it provides an additional margin of travel throw! (More on this in the future.)

JR

JR radios abbreviate endpoint adjustment in different ways. It's called ATV on the PCM-10, and on the X-347, it's called "T.ADJ." Both have a maximum of 150 percent throw to either side of neutral. This gives you very fine control over the extremes of servo travel.

AIRTRONICS

The default setting for the servo-throw extremes is 66 percent. (This applies to the Infinity 600 and Visions series radios.) While this is very realistic in terms of your flying needs, it allows a coarser adjustment than the other manufacturers offer. (Airtronics will be offering a finer adjustment system in the upcoming Infinity 660 and 1000 radios due out later this year.) One advantage of the Infinity 600 system is that when a transmitter says you have achieved 100% of servo throw, it means 100% and there is no more available.

ACE

Ace's* system for setting travel throws is unique. You use the appropriate transmitter stick to deflect the specified control surface while in the "Setting endpoints mode" (3.3a). This allows you maximum servo travel, and you choose throw by displacing the "stick" to the amount you want. When you depress the "Option" button, this amount of throw becomes the new limit of travel. As always, care must be taken to mechanically set up your servos to allow the appropriate control-surface travel before fine-tuning with the transmitter.

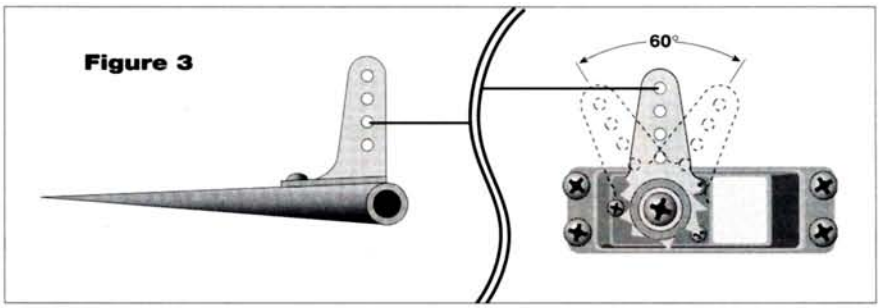
BENEFITS

By using these tricks, you may avoid the need to buy more powerful servos for a larger or faster plane you're planning, or you may even cure a flutter problem. You can be assured of more precise control. The only trade-off for power and precision is transit speed, yet a servo doing less work can also be a faster servo. Another point to remember is that in the manufacturers' servo specifications, speeds/times are sometimes recorded with 6V battery packs. Watch out for the fine print!

**Here are the addresses of the companies mentioned in this article:*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
JR; *distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.*
Airtronics Inc., *11 Autry, Irvine, CA 92718.*
Ace R/C Inc., *116 W. 19th St., Box 511C, Higginsville, MO 64037.*

I invite you to send in any problems (or creative solutions) that you may have encountered as you've programmed your radios. Be sure to include the make and model of your radio, as well as a rough description of your aircraft's layout, e.g., let me know if you're using a separate servo for each aileron. Include a complete description of what you're trying to accomplish. Send inquiries to Simple Programming, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

Figure 3



With reduced servo throw, you must use a hole that's closer to the inside on the control horn at the control surface. This gives the pushrod less leverage to overcome the burdens of weight and airflow as it moves the control surface.

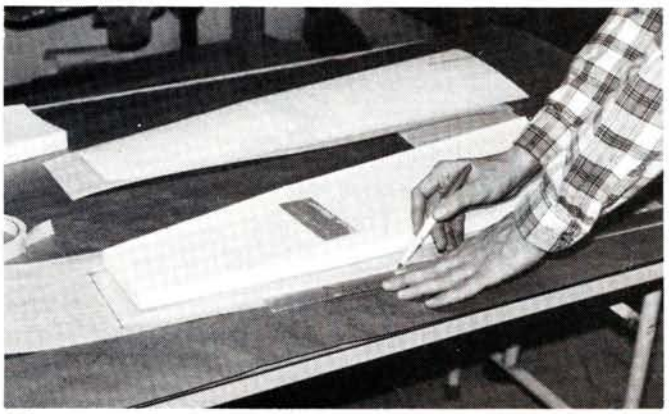
HOW TO

Sheeting with Obechi

by MICHAEL LACHOWSKI

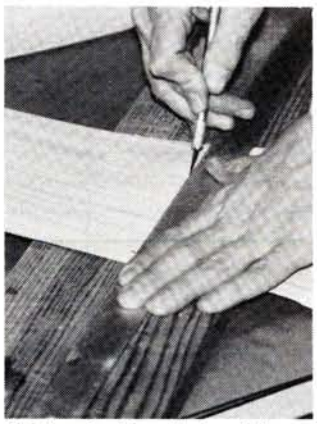
Try this balsa substitute

1



Using tape, outline the area that you want to cut, and then measure the dimensions and draw the actual cut line. Keep a roll of masking tape handy. A clear work space will lessen the chance that the wood will be bent or split.

2



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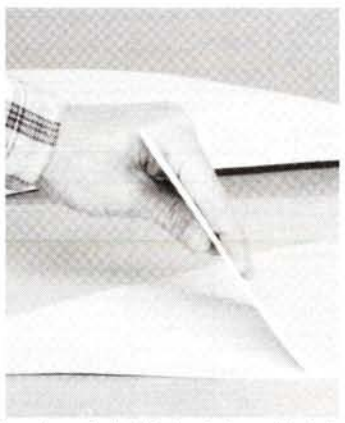


Cut the obechi on the taped line with a sharp knife blade. A sharp blade is especially important when you cut across the grain. Left: spread out the epoxy—you need only a little!—with a plastic scraper.

IF YOU SHEET foam-cores, then you know that it can be a challenge to find good, contest-grade balsa that's suitable for use as sheeting. Moreover, the work required to splice balsa sheets together can be a real pain. On most powered ships, you have to glue multiple sheets of 3- or 4-inch-wide balsa together to create a panel that's wide enough to cover the wing. On sailplanes, you have the additional work of building a 6-foot-long sheet. Thin hardwood veneers are a good alternative to balsa. Obechi is one of these woods, and it works well on models.

ABOUT OBECHI

Obechi is an African hardwood that's harder and heavier than balsa. It's available, e.g., from Dave's Wood Products*, in long (more than 6 feet), fairly wide, e.g., 15 inches, sheets—a definite advantage. Many European modelers use obechi because it's inexpensive, and it's strong, yet light.

To ensure that your wing will weigh the same as it would if it were sheeted with balsa, you use thinner sheets of obechi. It's available in a .025-inch thickness—less than half as thick as normal ($^1/_{16}$-inch) balsa.

AVOID SPLITTING THE WOOD

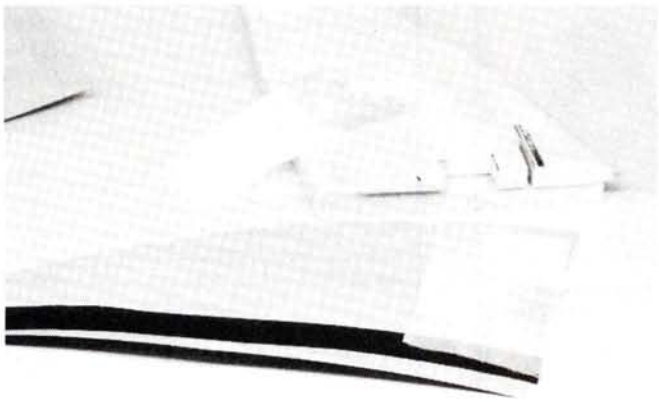
Working with obechi isn't much different from working with balsa. You can use the same adhesives and finishing techniques. However, you must be careful not to split the wood. Remember, this sheeting is very thin, so it's easy to split it along the grain before you apply it to the wing. Be sure to keep masking tape nearby while you work with obechi. Always put a strip of tape across the ends of obechi sheeting so that the veneer won't split. To fix any splits that do develop, simply put tape over them to hold them together until you've applied the sheeting to the core. (Be sure to apply the tape to the *outside* of the sheeting.)

CUTTING AND BONDING OBECHI

You'll also use masking tape to prevent the sheeting from splitting when you cut it. Simply apply the tape along the approximate outlines of the shape you plan to cut, and then draw the precise outline on the tape. Be sure to use a *sharp* knife so that you'll cut through the tape.

You can use your favorite method to attach the obechi to the core. I use epoxy and a vacuum bag; the bag holds the sheeting in

4



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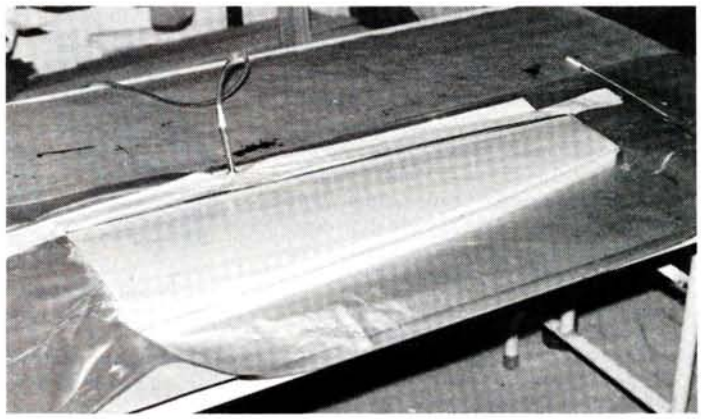


Left: For extra reinforcement, carbon-fiber mat and fiberglass cloth can be put between the foam and the obechi. Right: A vacuum bag is certainly easier on the work table than a huge stack of magazines! It's particularly useful for complex tip shapes or for sheeting a panel with multiple tapers all at once. The bag holds the wood down over all compound curves.

place until the epoxy has cured. Vacu-bagging equipment is relatively inexpensive; you can purchase a complete setup (including pumps) for approximately $80 from Composite Structures Technology* or Aerospace Composite Products*.

Use a thin laminating epoxy such as that offered by West System*. Apply it to the wood carefully, and remember that you only need a little; anything extra will just add weight. Brush it on a small area, and then spread it out by scraping it as shown. (A 3-inch plastic scraper with a clean edge works well.) After you've applied the epoxy and scraped it, the wood should look almost dry and there shouldn't be puddles. Don't pour a substantial amount of epoxy onto the wood and spread it out; rather, apply it a little at a time. This technique will prevent excess epoxy from "sitting around" and soaking into the wood.

Next, put the sheeting on the core, tape it in place along its ends and, if you plan to vacu-bag, put the wing into the bag. If you don't plan to vacu-bag, be sure not to let the epoxy seep through the sheeting to the core beds. Put wax paper or plastic between the sheeting and the beds, otherwise the sheeting will adhere to the beds.

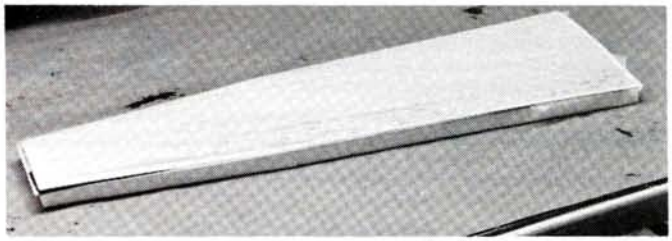
Because obechi veneer is thin and relatively hard, you may have to cut a few slits in it to work it over curves. This technique can be useful if you want to sheet a complex tip shape with one piece of sheeting. As noted, you can finish obechi just as you would balsa. You can create a "fine-furniture" look by applying a clear, colorless finish.

"Obechi is an African hardwood that's harder and heavier than balsa."

TRAILING EDGES

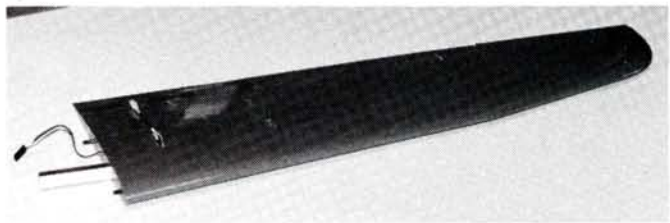
You might be concerned about the strength of the obechi on thin trailing edges. My favorite strengthening technique is to put a layer of 0.5-ounce carbon-fiber mat between the top and bottom sheets when I bag the wing. I use a little extra epoxy to "wet out" the carbon fiber, because I've found that, when it has cured, resin-impregnated carbon fiber is stiffer than fiberglass. If there are any cutouts in the wing, consider putting a layer of light fiberglass between the obechi and foam in these areas. This will make it easier to cut the sheeting when you're completing the wing, and it will do a better job distributing flight stresses around these areas. For very thin airfoils, you should also fiberglass the outside of each obechi trailing edge to stiffen and strengthen it. (After I've sanded each edge to shape, I apply a strip of 3/4-ounce fiberglass.) I hope you find this technique useful.

6



Here, the foam-core rests inside the obechi panels. You can see the carbon-fiber mat at the trailing edge. Note the masking-tape remnants on all the edges.

7



Here's a sample wing sheeted with obechi. The techniques used to finish obechi are the same as those used for balsa. Obechi is easy to sand and will accept most model finishes, paints and film coverings.

**Here are the addresses of the companies mentioned in this article:*
Dave's Wood Products, *#7 Creekpark Ct., Roswell, GA 30076; (404) 642-0645.*
Composite Structures Technology, *P.O. Box 4615, Lancaster, CA 93539; (805) 723-3783.*
Aerospace Composite Products, *P.O. Box 16621, Dept G, Irvine, CA 92714; (714) 250-1107.*
West System Epoxy; *distributed by Weston Aerodesign, 944 Placid Ct, Arnold, MD 21012; (301) 757-5199.* ■

AN ENTRY-LEVEL MACHINE IN A PREFAB PACKAGE

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

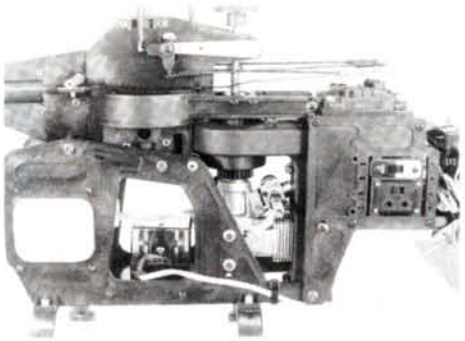
PHOTOS BY PAUL TRADELIUS

LION MODELS

Heli Cat

by PAUL TRADELIUS

INDY R/C* HAS recently started to import the Lion Models Helicat—the latest entry in the 30-size helicopter market. It's almost ready to fly and made of a strong plastic compound to withstand the bounces of novice fliers. The Helicat also comes with autorotation, a pre-balanced main- and tail-rotor assembly and a disengaging cone start system, and it uses modular construction of major components. This last feature lets you separate the helicopter into two or more major components, and it allows for easy removal of individual pieces for repair, adjustment, etc. Although it's aimed at entry-level fliers, the Helicat is designed for a wide range of engines from 32s to 46s, depending on the amount of power and capability you desire.



Here, you can see the strong plastic side frames and servo area. Note the ample room for servos and switches.

The Helicat comes in a large Styrofoam carton with all major parts assembled and balanced. It requires only the addition of an engine, radio and gyro; the attachment of the landing skids and rotor blades; and the application of the provided stick-on decals. A quite detailed instruction manual includes information about additional items required to build and fly the helicopter, blowups of component parts, detailed written instructions for final assembly and a parts breakdown. I was very impressed with the instructions because they not only clearly showed how to install the radio and gyro, but they also presented a very detailed set-up procedure. Also included is a section on flight training, a check list of items to take to the flying field, a thorough preflight check list and the basics of flying and required adjustments. Obviously, someone took the time to make the manual very "user friendly" so the helicopter will fly correctly the first time, even if you have no previous helicopter experience.

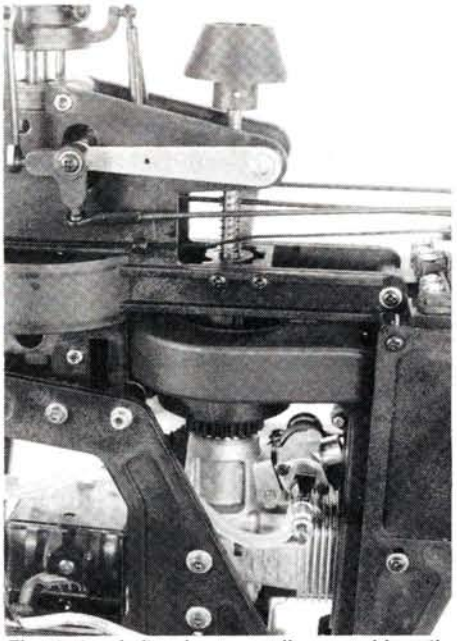
The head and swashplate are made of plastic and are assembled at the factory. Note the plastic paddles and heavy flybar weights for stability.

Heli Cat

SPECIFICATIONS
Model name: Helicat
Distributor: Indy R/C
Main rotor: 46.5 inches
Tail-rotor diameter: 8.6 inches
Length: 42.5 inches
Weight: 6 to 7 pounds
Gear ratio: 9.76:1:4.9
Engine: .32 to .46
No. of channels req'd: 5
Price: $249.95

ASSEMBLY

What little assembly there is starts with installing the engine. Because this is mainly a novice helicopter, I used a Super Tigre* 34, rather than the maximum engine displacement allowed. The entire clutch assembly is made of plastic, and there was a problem installing the engine. Although the engine/clutch/fan assembly is clearly shown in an exploded-view diagram, the diagram doesn't show how to use the prop nut to hold the assembly together. Also, no written procedures about this step are presented, and it should be mentioned to use thread-locking compound on the prop nut. I also couldn't secure the prop nut to the fan very tightly because the hole provided in the fan doesn't leave room for even a thin-walled socket wrench. It may be possible to drill out the fan to accept a socket wrench until a factory fix can be made.



The starter shaft and cone are disengaged from the fan by a spring to eliminate alignment and vibration problems. Note the plastic enclosure of main and secondary gear.

Although the Helicat does use a top cone starting system, the starter cone and shaft are spring-loaded to pull up and away from the fan after the engine has been started. This eliminates having to align the starter shaft and makes for a smoother and simpler operation. Because the head of the engine faces forward, a remote glow-plug adapter is necessary, or the canopy must be removed to reach the glow plug for starting.

The plastic landing gear are then bolted to the main structure. Their design is particularly good because they keep the helicopter high off the ground, provide good tail-rotor ground clearance and have a provision to hold a tube to route the receiver antenna wire away from the helicopter.

The tail rotor is of conventional design, but it has dual ball-bearing metal blade holders and comes factory assembled and balanced.

One of the nicest features of the Helicat is the area and method provided to mount the radio and gyro. The servo tray is completely molded of plastic and has ample room for the receiver, battery and the most popular types of servo; the mounting screws are even supplied in the kit. A separate plastic mounting plate is provided for the on/off switch and the gyro-sensitivity adjustment box, both of which are readily accessible through the right window of the canopy. And just when you think there's no way they could have made this radio installation any easier, you find that all the pushrods have already been installed and that they only require a simple hookup to the servo wheel. The entire radio installation is very well-thought-out and clearly presented in the instructions.

Usually, a helicopter review makes some mention of the mechanics, the rotor head and the tail boom/tail rotor. In this case, there isn't much to say, at least about their construction, since all these parts come assembled and ready to fly. However, let's take a look at some of the Helicat's design features.

Rotor head—Made of plastic, it utilizes large, molded blade grips, which are dual-ball-bearing supported, but lack thrust bearings. (Bushings are used instead of bearings in other places on the head—a factor in the heli's very reasonable price.) A one-piece feathering spindle is used to mount the blade grips to the main head body providing a very rigid assembly that should minimize, but not eliminate, tail-boom strikes. Large paddles with heavy weights are pre-balanced, but the weights can be removed for more aggressive flying. The swashplate is also made of plastic, with molded plastic balls, but other areas of the helicopter use both metal and plastic balls. Although my helicopter doesn't show any sign of wear in this area, plastic balls can be a weak spot after many hours of flying and may need to be replaced with metal balls at a later date.

Main mechanics—The gears in the mechanics are made of Delrin for long life and light weight, and are almost completely enclosed in an attempt to keep them just as clean as possible. The clutch drives a secondary gear, which in turn drives the main gear. The main gear also has conventional teeth on top for the tail-rotor drive-wire takeoff.

Tail rotor—Of conventional design using a pitch slider for control, it also has ball-bearing support for both the input and output shafts. Although the tail-rotor blades are plastic, their grips are made of metal and use two ball bearings each for a smooth, solid operation. I, however, did have a slight problem in this area when hooking up the tail-rotor control-wire to the servo. A stiff steel wire inside a plastic tube is used for tail-rotor control, but it was binding quite badly. It appears that if the wire bends at all as it's routed to the servo, the wire rubs on the plastic tube and binds. By bending the wire and not using the wire guide provided on the frame, I reduced the bind to an acceptable level.

This is the ideal gyro-mounting position: directly below the main shaft with the large fuel tank clearly visible during flight. You have to trim the canopy to allow for the muffler.

HELICAT

RADIO SETUP

I used the JR* PCM 9-channel heli radio with 401 servos and a JMW* gyro, all of which were very easy to mount in the space provided. The collective-pitch range can approach 20 degrees if required, but the pre-installed pushrod wasn't correctly adjusted at the factory to provide a usable pitch range for flight. This is obviously such a minor point that it's almost not worth mentioning, since in virtually all other kits the builder must adjust all pushrods. However, it would have been nice if the manufacturer provided at least a basic pitch gauge for initial pitch set-up. A paper cutout that fit over the blade and showed recommended high and low pitch settings would be useful to novices who may not have pitch gauges.

CANOPY AND TRIM

The canopy is made of a new plastic compound that's almost indestructible in anything but the most severe crash. The only disadvantage is that it doesn't readily accept most model paints, and therefore a stick-on decal sheet with an ample set of decals is provided. Depending on the engine/muffler combination used, a little of the canopy must be removed with a hobby knife for muffler clearance. The canopy can be mounted very quickly and easily; a front hook and two screws near the rear secure it in place. As already mentioned, the on/off switch and gyro adjustments are easily accessible through the right window.

The canopy can be mounted quickly and easily with two thumbscrews. No starter extension is needed, but hold the starter vertically to prevent wear on the plastic cone.

FLIGHT TESTS

The Super Tigre 34 was used on the Helicat's test flight; the engine started easily and was easy to adjust. Throughout its use, it has proved to be an excellent handling engine with good power, even with the manufacturer's stock muffler. Although no starter extension is needed, take care when you push down on the starter cone to engage the starter shaft to the fan. Also, hold the starter as vertically as possible, or the plastic starter cone will wear badly. The Helicat really should be equipped with a metal starter cone, but at this entry-level price, I guess we can't have everything.

I wish I could report that the rest of the first flight was uneventful, but it wasn't. On initial run-up, the Helicat started to shake violently. Anything that violent could only come from the main rotor blades, so they were removed and checked for balance. Although the blades are weighted, assembled and balanced at the factory, somewhere in the process the blades' weights had been mismatched; one blade required $4\frac{1}{2}$ pieces of tape to bring it in balance. I imagine that this was a one-time mistake by the manufacturer, but blades *that* far out of balance should be returned for a better set.

STURDY AND SMOOTH

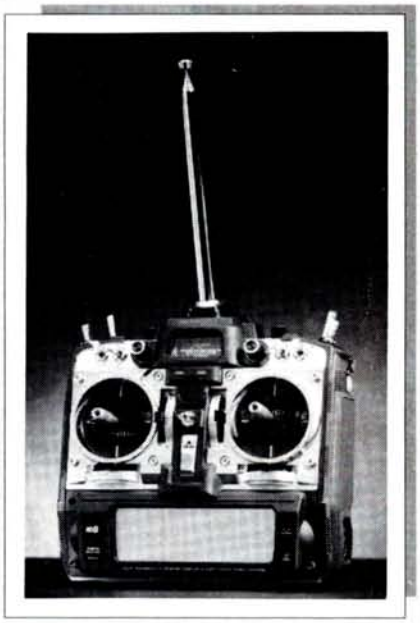
Initial flights on the Helicat showed it to be indeed designed for novice fliers. The thick plastic parts that enable it to withstand the punishment that a novice could dish out added to its weight. This helped its stability in the wind, but it limited flight performance using a stock 34 and muffler. Normal hovering and flying was very smooth and controlled because of the lower rotor speed and heavy flybar weights, but any advanced aerobatics aren't recommended with this setup. Autorotations can be performed in moderate wind, but again, because of the combination of weight and small blades, they're not recommended maneuvers.

Overall, I consider the Helicat to be an excellent buy for an entry-level helicopter. The large amount of prefabrication, durable plastic frame parts and pre-assembled and balanced main and tail rotors are definite pluses for novices who would rather learn to hover than how to build. Flight characteristics are very mild out of the box, but you can increase them as your proficiency improves by removing the flybar weights and installing a larger engine/tuned pipe system.

**Here are the addresses of the companies mentioned in this article:*
***Indy R/C Sales Inc.**, 10620 N. College Ave., Indianapolis, IN 46280.*
***Super Tigre**; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
***JR Propo Remote Control**; distributed by Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826.*
***JMW**; distributed by Miniature Aircraft USA, 2324 N. Orange Blossom Trail, Orlando, FL 32804.* ■

ROTARY-WING ROUNDUP

NEW HELI PRODUCTS



Descriptions of new products appearing on this page were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute an endorsement by **Model Airplane News**, nor guarantee product performance or safety.

JR REMOTE CONTROL
JR PCM-10S Heli Radio System

The new JR PCM-10S is an improved version of the PCM-10. Each screen displays nine codes for easier, more efficient code selection; a two-speed menu/settings scrolling function; a flight-mode warning that, on power-up shows which switch is out of position; gimbal-stick potentiometers that provide 70-percent better resolution for precise servo control; and an RF output meter that's now a battery voltage meter. Compatible with all JR G- and Z-Series receivers, all JR PPM receivers and the all-new JR S Series dual-conversion 1024 ABC&W receivers, this radio can transmit in PPM, 512 PCM and 1024 PCM. It holds settings for 10 models, and you can transfer data between 10S radios. With its new acceleration mixing, the 10S range has been increased to 35 steps to give you more exact mixing. Furthermore, 5 programmable mixes allow free mixing of all 10 channels and you can select RF fail-safe separately for channels one to eight.

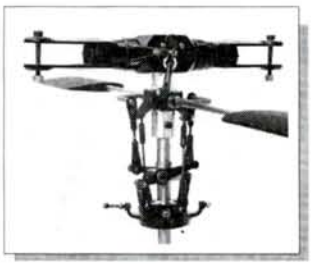
Part no. JRP 17

Prices: $1,199.95 to $1,449.95 (depending on servos).

Horizon Hobby Distributors, 3102 Clark Rd., Champaign, IL 61821 (JR Service Number: (217) 355-9511).

ROTOR TECH
Underslung Flybar Kit

Use this kit to upgrade any GMP Cobra, Competitor, or Legend rotor head; you can also use it on the Tech Specialties Phoenix upgraded heli. The kit provides a precision-machined aluminum replacement hub, a fully ball-bearing-supported flybar and seesaw assembly, and a ball-bearing washout assembly. Used with any GMP yoke and blade-holder assembly, it will improve your heli's cyclic response and add power to its rotor head. Cyclic and collective throws are maximized and balanced, providing completely predictable response in both positive- and negative-pitch setups. It's available in a black-anodized or machined-aluminum finish; there's a choice of main-shaft configuration; and you can choose a high/low speed FAI-type setup or a typical high-rpm setup.



Part no. RT-100

Price: $175

Rotor Tech, 21399 Mastick Rd., Fairview Park, OH 44126; (800) 831-9570.

NOVUS INC.
Cleaning and Polishing Products

Novus Inc. offers specially formulated cleaning and polishing products. Polish no. 1 provides a deep, lustrous shine, repels dust and acts as an anti-fogging agent. Polish no. 2 removes surface scratches, blemishes and discoloration. A kit that contains a bottle of no. 1 and a bottle of no. 2, six special applicator wipes and complete instructions is also available.

Price: $11.95 (2 ounces); $23.95 (8 ounces).

Novus Inc., Hangar Heins Aircraft, 475 Breezy Ln., Cincinnati, OH 45244; (513) 528-7221.

PBY

(Continued from page 41)

little lower in the water than I had expected, even though Bill Price had said that his lightest prototype had weighed only slightly less than that, and another had been up around 13 pounds. Anyway, with Jim at the sticks and advancing throttle further, the plane started to pick up speed in the water. It also picked up lots of water from the props, and the nose seemed to dig into the water like a submarine!

GETTING THE BUGS OUT

We soon saw that it would be a tricky job to get the plane airborne, since it was hard to overcome the drag of the spray on the props, and that made it hard to build up enough speed for the hull to get up on the step for takeoff. Eventually, our white-knuckled pilot did manage to get it up and flying. Flight characteristics and handling were positive and required only minor trim adjustments on elevator and aileron. Jim also found that he could get smoother turns and banks with the mixing control of aileron/rudder on his Futaba 7UAF radio. On the takeoff runs, we noticed that a lot of up-elevator was essential, and we increased the throw of that control in later flights.

Since our 10-inch props exceeded the designed size, it was clear that they'd be closer to

(Continued on page 90)

PBY

(Continued from page 88)

the water surface than if the 9-inch diameter had been utilized. We subsequently added a chine across the entire nose of the hull to help keep it from diving, and we tried 9x8 APC* props. We also increased the up-thrust of the engines to 2 degrees relative to the wing. These changes were tested on our next outing to the lake, and takeoff difficulties were lessened, although not eliminated. A pretty smooth water surface and a skilled pilot proved to be essential.

One of the special joys of flying the PBY model is observing it in the air, seeing it on flybys and in the landing mode. The appearance of this plane doing its stuff is simply marvelous. It flies quite fast, but not dangerously so.

In summary, we found the PBY-5A kit to be intensely interesting to work with. It's a kit, of course, but I'd say that a modeler with scratch-building experience would have a better result than one without that kind of experience. The finished product is a very sturdy airplane, with the ability to withstand major abuse in its contact with water. I think that the construction would have been easier if there were full-size plans included with my kit. (As I said earlier, however, all new kits will include the wing plans.) I also think Bill Price would be well

(Continued on page 93)

PBY

(Continued from page 90)

advised to spend some time editing the manual, as some glitches have crept in there. *[Editor's note: as of press time, we had received word that the manual had been revised, although we don't know to what extent.]* The videotape that Bill offers is a "must"—well worth its cost.

In recent phone conversations with him, I've learned that Bill has sold more than 400 kits in his line of amphibians. He's a machinist who teaches shop in a school in California and develops his plane designs during his spare time. Kit orders are filled with the help of his two high-school-age sons and his dad. As stated earlier, Bill is planning to include a new full-size wing plan for the PBY and is already doing some work toward editing his manual. With these later documents in the pipeline at G&P Sales, I expect the PBY-5A will become an easier and quicker project for R/C hobbyists to tackle. In any event, if you love the idea of flying a model Catalina on land or water and want to become involved in a challenging construction project, I suggest that you send three bucks to G&P for the information sheet to learn more and whet your appetite.

**Here are the addresses of the companies mentioned in this article:*
G&P Sales, *410 College Ave., Angwin, CA 94508.*
Irvine; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.*
Hobbypoxy Products, *a division of Pettit Paint Co. Inc., 36 Pine St., Rockaway, NJ 07866.*
APC Props, *P.O. Box 938, Knights Landing, CA 95645.*

BINGO

(Continued from page 48)

The covering process went quickly; the only problem was waving that 5-foot-long fuselage around in my 8-foot-long workshop. The MonoKote pearl finish went on well. Unlike some other brands of metallic-colored films, the pigment stayed in place and showed little or no tendency to separate from the heat-shrink base film. That's very important from an appearance standpoint; especially with the large surface area on the Big Bingo.

After I had completed the covering, I fuelproofed the engine and tank compartments

(Continued on page 94)

BINGO

(Continued from page 93)

with two brushed-on coats of Zap Epoxy Finishing Resin, and I re-installed all the hardware.

The radio I use consists of some old S-21 servos on the ailerons and a pair of 1/4-scale S-16 servos (both from World Engines) on the elevator and rudder. The transmitter and receiver were chosen simply because they were the only ones in my radio inventory not presently surrounded by an airframe—a plain vanilla, no-bells-and-whistles, 4-channel *AM* Futaba* Conquest! Prior to launching the Bingo on its first flight, I did a thorough range check at all power settings, and I found no electrical noise to cause any radio problems. Each aileron servo extension lead is about 24 inches long, and I did *not* use any in-line chokes or traps. The radio works just fine. Maybe I'm lucky or maybe I have a radio that's deaf to signals other than the ones it's supposed to hear, but it points out that you don't need to spend a fortune on a radio to operate your gas-powered planes.

With everything back in, or on, the airplane, which was really looking attractive at this point, it was time for the all-important (but often neglected) weight and balance checks. I was certain that I wouldn't need any nose weight, thanks to the ample avoirdupois of the

(Continued on page 98)

BINGO

(Continued from page 94)

G-38, but I sure didn't want to add anything to the tail either, which would only increase the 17-pound, 2-ounce weight of the airplane. In spite of a decidedly nose-heavy condition, which wasn't as bad as I thought it would be, I decided that it wouldn't present any real problems during flight. As you'll see in the flight-performance evaluation, it didn't.

What did I think of Ace's Big Bingo?—in a word, terrific! Ace R/C doesn't promote it as a giant-scale airplane, but rather as a giant sport. Its basic design has been proven over the years in a variety of sizes and variations. That means all of you modelers who have heard that "big flies better" now have an opportunity to prove it to yourself. My guess is that you'll probably become a staunch disciple of big airplanes and convince many of your fellow modelers likewise.

The Big Bingo is built like a smaller airplane, sharing the same techniques and materials; it uses the same sport radios you presently have (with the possible exception of the requirement for two large servos); and it can be transported as easily, thanks to the unique aluminum-tube wing joiner. When it comes to flying, the difference will become immediately apparent. If you're good with a smaller airplane, the Big Bingo will make you look great;

(Continued on page 100)

BINGO

(Continued from page 98)

if you're already great, watch out! A lot of Big Bingo fliers are catching up!

**Here are the names of the companies mentioned in this article:*
***Ace R/C Inc.,** P.O. Box 511C, Higginsville, MO 64037.*
***Zap;** distributed by Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414.*
***Top Flite Models,** 2635 S. Wabash Ave., Chicago, IL 60616.*
***Balsarite;** distributed by Coverite, 420 Babylon Rd., Horsham, PA 19044. **Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.*

SPORTY SCALE

(Continued from page 64)

Q. *I really love the scale wheels produced by Robart Manufacturing*, but I have a problem. How do I get them to support more weight? When used in my particular case, they look almost like flat tires, and this also affects the ground handling of my warbird.*

A: You can solve this problem in two ways. First, you can cut a donut-shaped piece of firm foam rubber and place it inside your tire—sort of like a solid inner tube. This will increase your tire's weight-carrying ability tremendously. The second and preferred way is to call Robart and order this foam donut from them. They're available in different sizes and will probably work better than the one you cut out of your floor mat.

IN CLOSING

So, time to go. Hope you enjoy the Top Gun coverage. By the way, T.G. will be the first weekend in May next year. Same place. Anyone feeling they deserve an invite for expert or team scale should write to me now. Our board meeting, where we consider all invitations, is coming up in about five weeks. Until that time, remember that there are two things connected to this sport of ours that have absolutely no value. One is the runway behind you,

(Continued on page 105)

SPORTY SCALE

(Continued from page 100)

and the other is the altitude above you. Your six is clear.

**Here are the addresses that are pertinent to this article:*
Bob Violett Models, *1373 Citrus Rd., Winter Springs, FL 32708; (407) 365-5869.*
Zurich Glasses, *c/o Newman Optical, 5083 Ridgedale Dr., Ogden, UT 84403; (801) 479-7733.*
Robart Mfg., *P.O. Box 1247, 310 North 5th St., St. Charles, IL 60174.*
Norwegian Bearcat, *c/o Helge Larson, Stasjonsvn 42B, 2010 Strommen, Norway.*

SEAHAWK

(Continued from page 27)

if the prop is forced.

With the model inverted, fuel may flow from the tank to the muffler via the muffler pressure tubing with potentially hazardous results. To prevent this, a simple ball valve is inserted in the pressure line just above the tank and aligned vertically.

This ball valve is composed of a two-piece aluminum fuel-line filter with a 5/32-inch-diameter ball bearing inserted inside (see photo 26).

When the model is upright, the ball should rest on the screen; inverted, the ball

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SEAHAWK

(Continued from page 105)

will fall into the unscreened half of the filter, preventing fuel from flowing into the muffler. Ball bearings are stocked by most bicycle shops. Mine cost a nickel each.

FLYING

Here's where the fun begins! The Seahawk is fast, stable, yet responsive. Flaps aren't needed for takeoffs—both land and water; and the model has demonstrated knife-edge flight capability with wheeled landing gear.

Use low rates on aileron and elevator for high-speed flight, and high rate if flaps are down. On a very windy day, land flaps up. On calm days, flaps are almost mandatory, unless water-flying. The glide is so shallow, flap up, that it's easy to overshoot the runway. With flaps down, engine idling, very

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GOLDEN AGE OF R/C

HAL DeBOLT

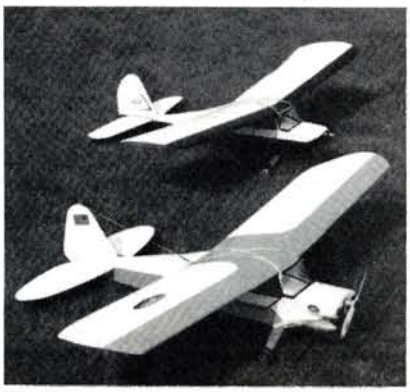
PURSUITS AND LOGICTROLS

FIRST, I'LL fulfill my promise of last month to tell the story of the LW Pursuit.

The design goes back to the late '50s. Inspired by the success of the Astro Hog, I had developed my first low-wing R/C plane—the Crusader—and it was featured in the August '59 issue of *American Modeler*. I had learned a lot with the Crusader, and the knowledge gained led to the development of the Pursuit. I also drew on information gleaned from previous high wings and the Custom bipe.

Retired coal miner Lynn Vandermark with his Fox .19-powered LW Super Cub—very aerobatic. He uses a modern radio with REM controls.

The Crusader wasn't flying long before I realized that a low-wing R/C plane might do much better if it was based on full-scale practices rather than on modeling experience. The Pursuit was the result—a simplified, improved structure with modified "aerodynamics." With the Pursuit, I decided that I at last had a low-wing design worthy of the Live Wire name. The original was powered by a K&B .35 and controlled by a Bramco 8-channel reed system. Much later, the same model was used to evaluate the exciting new Space Control propo system—an experience that changed the whole ball game as far as R/C systems were concerned!



Lynn Vandermark's two Ghost models. The LW Champ, which was first flown in 1955, still performs well with an O.S. 10. The Super Cub was framed in the mid-'50s but only recently completed.

The Pursuit gained fame by establishing a world closed-course distance record of 23km at Millersport, NY, in July '60. To do this, I merely substituted a Fox .19 for the usual .35. The Pursuit also won the '61 Japanese National Champs in Tokyo. Another one, modified to look like the Stitts Playboy, was flown in the first FAI World R/C Champs in Zurich. Unfortunately, halfway through its first flight, a broken battery wire led to its sudden demise. The LW Pursuit kit proved successful; several thousand were sold.

E-K MAIL

You people can be so helpful! Last June, I asked for information on E-K Logictrol and, as a result, I was recently able to discuss E-K at some length. Well, the mail has brought more info! Le Grande Blackley of Woods Cross, VT, sent more literature—even some schematics!—and Chris Greenwood sent a similar package all the way from Sunbury, Australia.

This 1976 literature indicates that E-K offered six systems with from three to seven channels. The company also offered a "standard" equipment package and an "in-the-brick" style as well as a choice of Mode I or II or single stick. You also had a choice of servo trays and a variety of accessories. Logictrol sure was versatile! The modern-day features included dual-conversion receivers, adjustable control sticks, battery meters and a choice of battery packs and servos. Nearly 20 years ago, you could "tailor" as you wished!

Chris obtained his Logictrol 3 in 1968 while he was in Switzerland, but he couldn't use it there. The Swiss FCC band width requirements were already too *narrow* for American radios!

After moving to Australia, Chris obtained a couple of Logictrol Pro systems (in 1973), and he says that they've served him well Down Under. He still uses some of the equipment. He also cites an example of E-K's innovations in those early days: open gimbal sticks and three-wire servos—like those used today—when all the other systems used four-wire servos.

Cliff Swartz of Winnipeg, Canada, checked in to say that he was involved as a Canadian outlet for E-K. Such a close relationship enabled him to provide many details. Cliff, whose OT R/C activity includes flying an LW Champ and a P-Shooter, says that the partnership of Bob Elliott and Jerry Krauss began in Westminister, CA. It was there that the first Logictrol was produced, and E-K apparently followed Bonner's lead by incorporating a fail-safe feature. If a glitch occurred or the signal was lost, the receiver "froze" the servos in whatever position they were in for one second. If the problem persisted, all the controls returned to neutral and the engine went to low speed. This feature was eliminated from all future systems. Apparently, Elliott and Bonner couldn't find any evidence that it was worthwhile, so its complexity began to outweigh its value.

A second Logictrol system was also produced in California, and it featured a vinyl-covered transmitter case. In those days, flying in extremely hot or cold weather was often disastrous. Holding a transmitter in hot weather was like taking a hot pan off of a stove. In cold weather, your fingers practically froze to the case.

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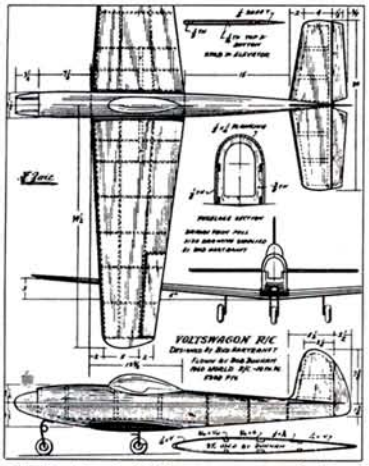
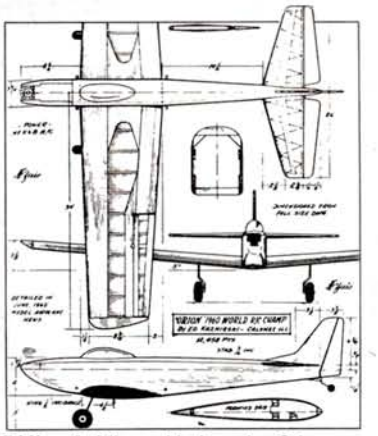
OT R/C DESIGNS FOR TODAY'S ACTION

As I've intimated over and over, those who are searching for OT R/C designs that are suitable for today's action actually have a wealth of pretty airplanes from which to choose. However, it should be noted that just because a plane is attractive doesn't mean that it's a strong performer. I'll try to lead you down a rosy path, but your choices should be made carefully.

For aerobatic-pattern-type modelers, the guidelines of the two OT R/C organizations are different. The VR/CS cutoff date is 1965, and the SPA date is 1970. Obviously, it's best to choose a design that's legal in both organizations. Research indicates there are many pre-'65s that fit the bill, including the following two, which were flown in the '60 World Champs. They should perform very well with modern .40 engines—you don't need a big fuel-guzzling .60!—and this makes them even more attractive.



Bob Dunham's Voltswagon was designed by Bud Hartranft. It was equipped with a K&B .45 power and Orbit reeds. Note the trike gear and the 9-percent symmetrical airfoil. The plane had a 690-square-inch area and weighed about 5 pounds.



Ed Kazmirski's world-champion Orion was powered by a K&B .45 and used an Orbit "relay-less" reed system. Note the 15-percent semisymmetrical airfoil and two-wheel gear. The plane weighed approximately 5½ pounds.

DUNHAM'S VOLTSWAGON

This design pointed the way to today's pattern designs—both aerodynamically and structurally. If you consider the Bud Hartranft design, point by point, you'll find all the considerations used by today's designers. Note the fully sheeted symmetrical wing, the trike gear with the "steerable" nose wheel and all the rest. (It was too bad that the engine on Bob's plane conked out during his two flights at the Champs. Would you believe it performed flawlessly during a month of demonstration flying afterward?)

KAZMIRSKI ORION

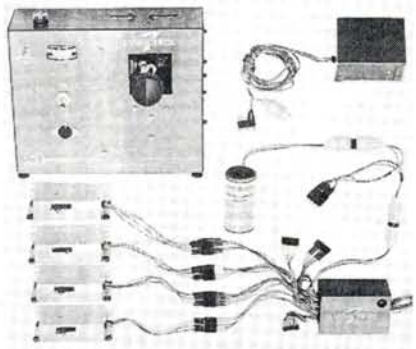
Kaz's airplane was slightly more old fashioned than Dunham's, but it's hard to fault a world champion! Kitted by Top Flight, many, many of that day's pattern fliers cut their teeth on the Orion. What the Zipper was to free flight, the Orion was to R/C pattern. I guess that there are many who'd like to duplicate what they flew in the '60s; you too?

Plans for the Voltswagon and the Orion are available from Tom Dixon, P.O. Box 671166, Marietta, GA 30066.

It was hard to keep your mind on flying in either instance! The vinyl covering solved this problem, and it also added a touch of class.

This radio also featured Dunham servo mechanics that used an amplifier developed by Elliott. This setup may have established a new standard for servo accuracy; it incorporated a Schmidt trigger circuit that created a very narrow dead band—technology that's still used in today's servos.

The third series of E-K systems evolved when the company moved to Texas. At that time, E-K established an in-house tool room and the ability to produce their own mechanics and plastic moldings. This allowed them to make still more servo/gimbal innovations. The most notable of these was the development of progressively smaller servos that also became increasingly reliable. (They were in the range of today's mini-servos.) With the development of a 10-channel system and the addition of such features as dual conversion, the company's electronic advancements paralleled those made in mechanics.



This is one of the first Logictrol systems. The hole in the large receiver is for RF tuning. Note the use of Bonner servos and the separate battery charger—wires that won't quit!

Incidentally, E-K moved to a simple Galloping Ghost system that featured Rand actuators. The company also produced radios for the Jerobee cars, which probably started the R/C car movement. Cliff concludes—and most would agree—that E-K produced innovative, reliable equipment, and today's modelers owe the company much!

Ron Clem of San Diego provided even

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SEAHAWK

(Continued from page 106)

steep, slow approaches are possible. Happy one-piece landings.

**Here are the addresses of the companies mentioned in this article:*
Sullivan Products, *P.O. Box 5166, Baltimore, MD 21224.*
MonoKote/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
Carl Goldberg Models, *4734 West Chicago Ave., Chicago, IL 60651.*
O.S./Great Planes Model Distributors.

GOLDEN AGE

(Continued from page 110)

more Logictrol info. He relates that, on early systems, E-K used a "shorting plug" in place of a receiver switch. (Was it simpler and more positive? Perhaps the widely used "Noble" switch hadn't yet reached the market.)

Ron also tells the story of how one modeler learned what *not* to do with the plug. Apparently, the plug seemed the perfect place to mount a dummy machine gun, and you can probably guess what happened. The additional weight of the gun caused the plug to vibrate during flight with the inevitable result!

Ron provides still another example of E-K's reliability. He and his buddy could switch between their transmitters during flight, and the model never noticed the difference! He also reminds us that E-K produced a proportional wheel brake that would cause the tires to skid when full on. E-K sure covered the R/C spectrum!

James Heishman of Lufkin, TX, bought his Logictrol Champion in 1974, and it's still going strong. Installed in an O.S. 20-powered Midwest Esquire, it was Jim's trainer. He says he has lost count of how many crashes it has survived! One, which was caused by wing failure, started at 300 feet. For OT R/C, Jim will have another Esquire equipped with the original Logictrol. Back to square one?

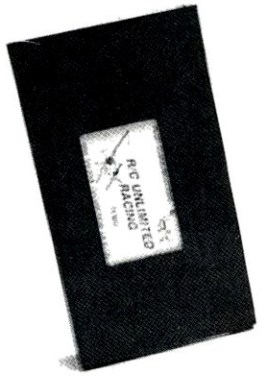
Jim shared the rumors that he has heard about the fate of E-K, including one that says there's a mother lode of E-K equipment stored in a warehouse somewhere in California. I vaguely remember that, when E-K closed its doors, the operation was taken over by a hobby business in Oregon that offered parts and some equipment. Sorry; the details escape me. Can anyone help?

Jim concludes by saying that he has a couple of English OT R/C kits—a Mercury Junior Mallard and a Keil-Kraft Piper Super Cruiser. Do they ring a bell with anyone?

And so it goes; many of you are enjoying OT R/C worldwide. Isn't this just a great hobby?! Do remember that this is your OT R/C place!

video views

by JEF RASKIN



R/C UNLIMITED RACING

Subject: *The first R/C unlimited race at Madera, CA*
Source: *Pilot Communications, 9865 Galena, Cucamonga, CA 91730*
Summary: *Exciting action; one of the most engaging R/C tapes.*
List price: *$24.95*
Length: *75 minutes*

The idea is simple: scale the Reno Unlimited air racers down to 100-inch span, take the pilots out of the planes, set up a couple of pylons, and have at it. The resulting races have captured the attention of the modeling community, and you can see why: it's hard to pull your eyes away from the video while each heat is shown and expertly narrated. If your muscles don't tense and your stick fingers don't twitch as you watch this, you've never flown R/C.

The video has some technical information but is mostly devoted to the sights and sounds, the victories and the crashes—everything but the smell and the dust of the R/C unlimited races.

Professionally shot and produced, the tape is marred only by the interfering wooden posts of the viewing stand and the equally wooden dialog of the opening segment. This tape is so exciting and moves so well that the perpetually pulsating canned music is only a minor distraction.

WRING IT OUT, VOL. 2

Subject: *How to fly R/C aerobatics*
Source: *Carl Goldberg Models Inc., 4734 W. Chicago Ave., Chicago, IL 60651*
Summary: *Fine exposition on flying R/C power plane aerobatics. The second of three volumes, it has lots of well-presented, valuable information.*
List price: *$24.99*
Length: *40 minutes*

Dave Patrick, Canadian flying champion, shows with sparkling examples how R/C aerobatics should be flown. Taking off from where the first volume landed, the tape discusses a wide range of topics that are valuable to the flier questing for perfection in R/C power aerobatics.

The tape has two major segments—the equipment and flying. Patrick speaks with quiet authority, getting an amazing amount of detailed information into a few minutes: the need for a good airplane, the importance of gapless control-surface hinging, why tuned pipes are an advantage and how to tune them, how to tell if a prop is the right size, fuel choice for 4-strokes (2-strokes were covered in Vol. 1), why two-blade props are superior to those with three or more blades and the benefits of soft engine mounts. The segment on propellers, where Patrick makes the point that choosing the correct prop is analogous to driving a car in the right gear, reminds me that our hobby is in desperate need of constant-velocity props, which are to planes what transmissions (in fact, automatic transmissions) are to cars.

A well-thought-out discussion on using computer radios emphasizes that they aren't necessary, but very, very nice to have. It explains that you shouldn't try to fix a badly designed or badly set up airplane via adjustments on the transmitter. Get the plane and linkages right; radios are for fine-tuning.

Planes flown include Goldberg's Ultimate and Extra 300, and Dave Patrick's own Conquest 7 pattern ship. "The most important part about precision aerobatic

(Continued on page 129)

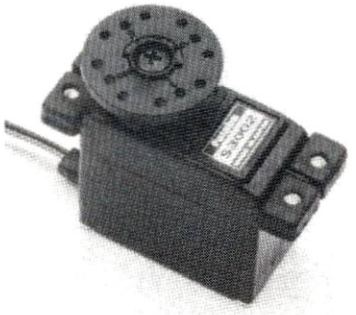
PRODUCT NEWS

U.S. AIRCORE
Trainer Guarantee

For 40 Family Trainer kits purchased between July 1, 1992 and June 30, 1993, U.S. AirCore makes the following guarantee:

If you crash and destroy your Trainer before you learn to solo, we'll replace it, free. This offer requires that you learn under the supervision of an AMA-club-designated instructor at an AMA-approved club site with safety rules and frequency controls in effect. Irreparable planes must be returned to U.S. AirCore Labs with a signed warranty form. The 64-inch-span 40 Family Trainer is die-cut from AirCore® material, and it comes decorated and requires a .40 to .45 2-stroke engine or a .50 4-stroke engine.

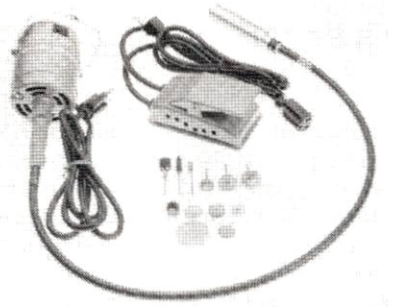
U.S. AirCore, 4576 Claire Chennault, Hangar #7, Dallas, TX 75248; (214) 250-1914.



FUTABA
High-Torque Miniservo

The Futaba S3002 servo is designed for use in sailplanes, small helicopters and other models that require a lot of torque (45.9 ounce/inches) from a compact unit. It has metal gears (for extra strength), a waterproof/dustproof case, a shock/vibration-resistant potentiometer, a custom Futaba integrated circuit and thick-film, gold-plated connector contacts. (Specifications: transit time—0.20 second/60 degrees; weight—1.2 ounces.)

Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718; (714) 455-9888.

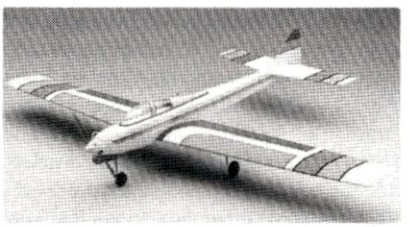


MARC'S MODELERS' TOOLS
Procraft Flex Shaft

This high-quality tool is for modelers who want the best performance at the best price. This 1/10hp unit is perfect for drilling, sawing, milling, de-burring, grinding and buffing. Made in the USA, it comes with a foot-operated variable-speed controller (0 to 14,000rpm), and it has lubricated ball bearings for no-maintenance operation. Marc's also offers a wide variety of accessories (most under $3).

Price: $165

Marc's Modelers Tools, 809 Sansom St., Philadelphia, PA 19107; (215) 925-4566.



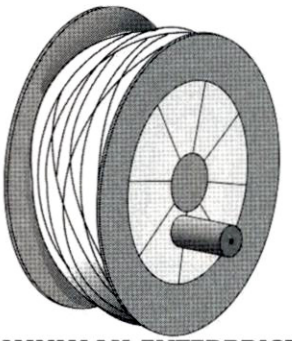
GLOBAL HOBBY DISTRIBUTORS
Birdie Forty

Made of the finest balsa, lite-ply and spruce, the Birdie Forty looks like a classic pattern ship. It has tricycle landing gear for easy ground handling, and its airfoil is almost symmetrical at the wing root, and it gradually changes to a nearly "flat-bottomed" tip. The Forty comes with basic hardware. (Specifications: span—61.25 inches; area—516 square inches; engine—.36 to .45 2-stroke; radio—four channels required).

Part no. 232184

Price: $74.95 (typically discounted to $49.99)

Global Hobby Distributors, 10725 Ellis Ave., Ste. E, Fountain Valley, CA 92728; (714) 963-0133.

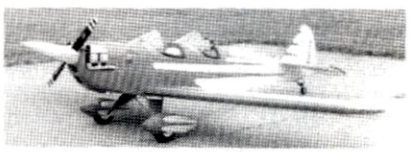


MINIMAX ENTERPRISE
High Start

The High Start will launch a 1- to 5-pound Glider up to 600 feet. It includes a 5/16-inch-diameter, 100-foot-long piece of UV-safe Ratex tubing that will stretch to 300 feet and net a 10-pound pull. One end of it is tied to a 9-inch metal stake (25-pound test), and the other end is tied to a 500-foot nylon cord (75-pound test). The end of the cord has a 1-inch-diameter, dead-drop, smooth-plated metal ring that will ensure good releases. The cord is rolled onto an easy-wind, 12-inch-diameter, UV-protected plastic spool. (The Ratex tubing, the nylon cord and the spool are all brilliant orange.)

Price: $46

Minimax Enterprise, P.O. Box 2374, Chelan, WA 98816; (509) 683-1288.



SIG MFG.
Spacewalker II

The 1/4-scale Spacewalker II is perfect for lazy Sunday afternoon flying, yet its scale accuracy is enough for full-blown scale competition. This deluxe kit features high-quality balsa, spruce and plywood parts, a molded-plastic cowl, plastic wheel pants and wing tips, bent-wire landing gear, three-view drawings, decals and patterns for two paint schemes, beautiful full-size plans and a complete hardware package.

Part no. RC-59

Price: $209.95

Sig Mfg., 401-7 S. Front St., Montezuma, IA 50171; (515) 623-5154.

PRODUCT NEWS

HITEC
Focus 6 "Pro" FM Radio

The AMA 1991-listed "total-control" R/C system includes a "souped-up" 6-channel SMT transmitter for races and fun flys. It has the following features: a Hi-Gain "rubber-duck" antenna for competition flying; servo-reversing; aileron, elevator and rudder; ATV endpoints; high/low-throttle endpoints; a trainer jack (Futaba compatible); an open-gimbal, five-wiper potentiometer; tension/length adjustment sticks; a retract switch; proportional flaps; and an ergonomic case. It comes with a 650mAh Ni-Cd battery, a battery meter, a charger, four hot HS 422F 0.15-second servos, servo trays, horns, hardware and a 7-channel RCD receiver—all with a one-year warranty!

Part no. HRS3300

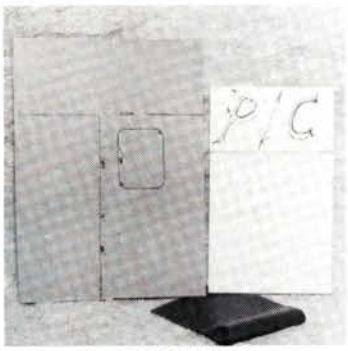
Price: $289.95

Hitec Radio Control USA Inc., 9419 Abraham Way, Santee, CA 92071; (619) 449-1112.

GENE BARTON
Retracts and Accessories

Gene Barton specializes in accessories for aircraft with spans of 80 inches or more. The company's line includes retract mechanisms, air systems, struts, wheels, tires, spinners and more. (Malcom Hood canopy options are available.)

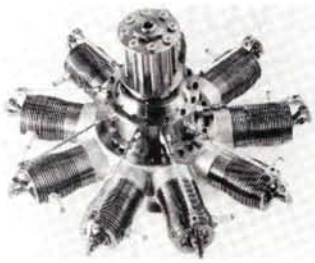
Gene Barton, 11640 Salinaz, Garden Grove, CA 92643; (714) 539-9142.



SMILEY'S
P/C Sheeting

With P/C sheeting, you can easily give your fighter or bomber a metal-panel look that will set it apart from models that have been covered with film. This 0.007-inch-thick, extruded, cloth-impregnated sheeting is lighter than traditional epoxy-glass and balsa composite. You simply apply it in panel sections and paint it—no sanding necessary. Decorate it with rivets, and you'll swear that it's a metallic surface.

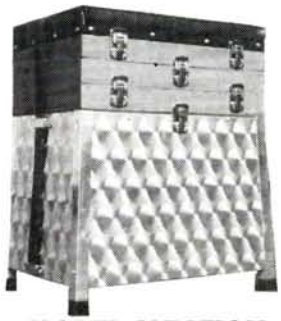
Clarke Smiley, 23 Riverbend, Newmarket, NH 03857; (603) 659-3380.



REPLICA ENGINES
Gnome Rotary

Replica Engines presents the first in a series of fully operational, historically significant, museum-scale aircraft engines—the Gnome Rotary. This 1/4-scale recreation of the W W I-era Gnome Monosoupape (single-valve) engine is made of machined and cast parts. This 9 1/2-inch-diameter engine is extremely impressive when it's running; it gives you a realistic feel for the full-scale version. This limited-production engine has an introductory price of $3,800. (A 10-percent deposit will assure serious collectors of an engine from the initial production run.)

Replica Engines, 16640 S. 104 Ave., Orland Park, IL 60462; (708) 403-7576.



MODEL AVIATION TECHNOLOGY
Field Box

This light, fuelproof field box has four storage compartments and will hold all the gear you need for a day of flying. It's made of brushed aluminum, wood and leather, and you can use it as a seat at your field! (No assembly required.)

Price: $85

Model Aviation Technology, 12848 Touchstone Pl., Palm Beach Gardens, FL 33418; (407) 626-6955.

MALLORY
Prop-Loc

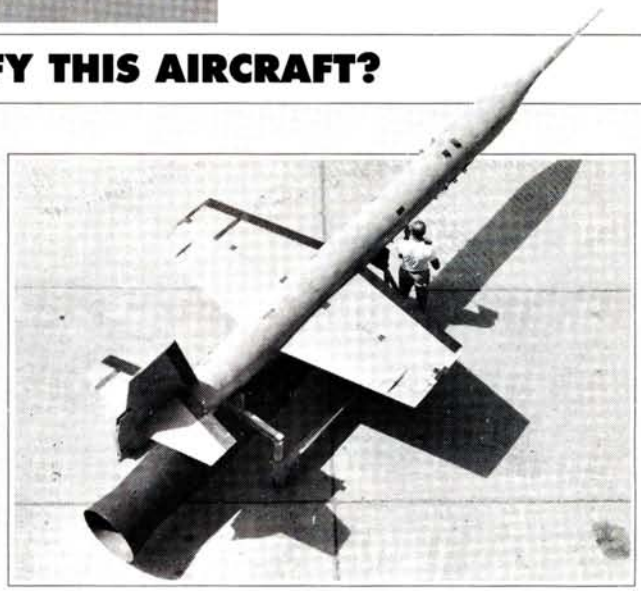
Sometimes, it's hard to keep your prop secured properly, because the hardened-steel drive washer doesn't grip it firmly. Prop-Loc washers can solve this problem. They're made of a gritty material, and you install them between the prop washer and the spinner to keep everything in place securely. (Most engines will accept 1-inch-diameter washers with 1/4-inch-diameter holes.)

Price: $2 (and an SASE) for two.

Mallory Prop-Loc, 39 Farrwood Dr., Bradford, MA 01835.

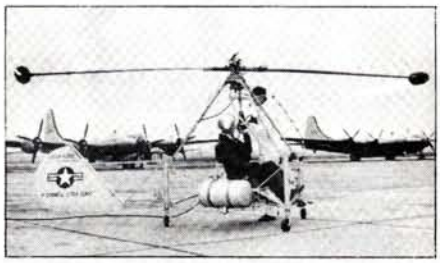
NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?



If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Charles P. Stover of Ridgefield, CT, for correctly identifying July's mystery plane—McDonnell Aircraft's XH-20. In this 1947 photo, the jet-propelled helicopter (dubbed "Little Henry") is making its debut at Wright-Patterson Field in Dayton, OH, with pilot C. R. Wood at the controls. Ram-jet engines were located at the rotor tips, thus avoiding the mechanical problems associated with transmissions. The project was cancelled because the helicopter was too loud and consumed too much fuel. ■



The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLUB OF THE MONTH

BAY FLYERS MODEL CLUB
P.O. Box 355, Maplewood, WI 54226

The July edition of "News and Views," which is published by the Bay Flyers, contains a list of coming events that shows this club's dedication to promoting the hobby and encouraging beginners. Geared toward beginner glider pilots and *not* intended to be a serious competition, a non-sanctioned August event—the Glider Fun Fly—involved timed flights and bonus points for spot landings. The club's annual Fall Fun Fly—their fifth—is intended solely to demonstrate model aviation to the public. Door prizes are not only awarded to the fliers, but to the public, too!

In this issue, editor Larry Huber gives his final report on Youth/Hobby Day at Southern Door Schools. It was apparently highly successful: more than 80 students enjoyed the static displays of indoor models and R/C models, and they appreciated the information packets and plans for an indoor "chuck glider" and Thermic 18 that they took home. Following the success of this event, the club has been asked to repeat it for children at other facilities. It's this kind of positive program that helps to ensure the future of our hobby. The Bay Flyers are to be commended for helping to kindle the interest of kids and for warming up an all-too-often alienated general public to the idea of model aviation.

Editor Huber also reported on the visit he and his wife, Audrey, made to the AMA National Flying Site in Muncie, IN, where he was number two in line to fly at the first ever Grand Fun Fly on June 13. He reports, "The flying site is superb! Two free subscriptions are on their way to the Bay Flyers.

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the ***Model Airplane News* Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You will have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address and telephone number.

HOBBY SHOPS: Act now and get the first ad free!
Directory space is sold on a yearly basis with a choice of three payment plans: 1. $179 per year, payable in advance; 2. $97 for six months, payable in advance; or 3. $17.50 per month to be billed monthly. Space reservations must be received by the 10th of the third month preceding publication (for example, January 10th for the April issue).

FLORIDA—Winter Springs
- UPS orders shipped daily
- Dealer for Yellow Aircraft
- Send $3 for Yellow info pack
- Full line of hobby accessories
- Visit our showroom (35 min. from Disney World)

BOB FIORENZE HOBBY CENTER, INC.
420 W. S.R. 434 **(407) 327-6353**

ILLINOIS—Chicago
Chicago's largest hobby shop. R/C planes, helicopters, boats and cars. R/C repairs, installations and custom building. Mon.-Fri. 10-9; Sat. 10-6; Sun. 11-4.
STANTON HOBBY SHOP, INC.
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Aeromodelos, carros, barcos e helicopteros radio controle.
Modelos plasticos para montar, partes e consertos.
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Av. Silviano Brandão 2100
Tel.: 55-031-463-9944 **Fax: 55-031-461-5501**

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R/C planes, helicopters, boats and cars.
Huge discounts on all R/C equipment.
Futaba radios at incredible savings!
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Full line of parts and accessories *Huge inventory! If we don't sell it, they don't make it!*Bob Violett dealers
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Discount prices everyday!
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THE ULTIMATE HOBBY
7021 Veterans Ave. **(718) 241-8434**
(Off Ave. "U" & E. 70th)

NEW YORK—Penfield
Full-service hobby shop
27 years of R/C experience!
Airplanes, boats, rockets, pine cars, plastic and wooden models, tools, accessories.
Daily UPS shipping worldwide—special orders encouraged!
Dealer for Ace, Hitec, JR—sales and service.
PANCO HOBBIES
1865 Penfield Rd. (Rt. 441) **(716) 383-1320**

Send sales message and payment to
Model Airplane News **Hobby Shop Directory,** 251 Danbury Rd., Wilton, CT 06897.
For more details or information on our special introductory offer, call toll-free (800) 243-6685 and ask for Classifieds.

CLASSIFIEDS

Non-commercial Rate: 15 words or less, $4.50; additional words, 25¢ each. No charge for name and address. (No commercial ads of any kind accepted at this rate.) Commercial Rate: 50¢ per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. All ads must be paid for in advance. To run your ad for more than one month, multiply your payment by the number of months it is to run. Deadline: the 10th of the third preceding month (e.g., January 10 for the April issue). We don't furnish box numbers, and it isn't our policy to send tear sheets.

SEND AD AND PAYMENT TO: CLASSIFIED ADS, MAN, 251 Danbury Rd., Wilton, CT 06897.

WANTED: model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

1930s to 1950s MODEL AIRPLANE MAGAZINES; 1930s aviation pulps, complete and good condition; $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

START YOUR OWN HOBBY SHOP or buy for friends or group; 30 to 60 percent off. For information, send $1 and no. 10 SASE: R&L HOBBIES, 10334 Portage Rd., Box MAN, Portage, MI 49002.

GIANT SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667.

WANTED: model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

WANTED: Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE: 100 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid U.S., Foreign $20. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

INTERNATIONAL AIRCRAFT RESEARCH—Need documentation? Include name of aircraft for availability of documentation with $3 for 3-view and photo catalogue. 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3.

WANTED: your old proportional radios; interested in pre-1980, American-made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486.

WANTED: old unbuilt plastic model kits. Planes, military, figures, cars, promos. Aircraft or missile desk models. Send list, price. Models, Box 863, Wyandotte, MI 48192.

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $2 for large list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555. (619) 375-5537.

FOAM WING-CORES, floats, EPS blocks. All foam cut on Tekoa feather-cut system. Will cut to your specifications. Call or send to: SKY BLAZER PRODUCTS, 448 Vienna St., Newark, NY 14513; (315) 331-7464.

BUTTON-HEAD SHEET-METAL SCREWS—no. 2x1/2, $4.90 for 100; 4-40x3/4 alloy socket caps, $4.75 for 100. New, lower prices on metric socket caps. *Free catalogue*—contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (908) 806-4050; Fax (908) 788-2607.

NI-CD ANALYZER SOFTWARE for DOS. Ensure your batteries are delivering peak performance. Calculate capacity and plot discharge curves for voltage measurements collected during discharge tests. Complete instructions for collecting data and using program. Specify 3 1/2 or 5 1/4 disk. Send $20 to LAMANTIA PRODUCTS, P.O. Box 672, Station B, London, Ontario, Canada N6A 4Y4.

MODEL MAGAZINES (1930 to present): *Air Trails, American Aircraft Modeler, Flying Aces, Flying Models, MAN, RCM* and others. Complete sets and spares available. David L. Brown, 61 Coach Rd., Glastonbury, CT 06033-3237; (203) 659-2412.

SCALE MODEL RESEARCH Aircraft Documentation. World's largest. Over 3,300 different Foto-Paaks and 20,000+ drawings. Catalogue $4. 2334 Ticonderoga, Costa Mesa, CA 92626 (714) 979-8058.

CRASH-RESISTANT composites; 120 types of aircraft, boats and rocket engine kits. Send three stamps to WILLAIRCO, 2711 Piedmont Rd. NE, Atlanta, GA 30305.

MODEL MAGAZINES, send $1 for list. B. Apgar, 18 Mt. Joy Rd., Milford, NJ 08848.

P/C—THE EASY WAY to simulate metal panels; $1 gets info and sample. Clarke Smiley, 23 Riverbend Rd., Newmarket, NH 03857.

AVIATION VIDEOS—the video history of aviation available through our catalogue: WW I, WW II, Korea, Vietnam, Persian Gulf and more. Send $7.50 to Oranian Video, P.O. Box 852, Woodbridge, NJ 07095.

WANTED: complete engines/parts for airplanes, outboards, race cars prior to 1960. Wes Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003 or 907-0930.

VACUUM-FORMING—do it yourself! New, 128-page, illustrated book shows you how. Make car bodies, helicopter canopies, airplane parts and boat hulls. Start with ultra-low-cost, basic setup, or form up to 1/8-inch-thick plastics with innovative two-stage vacuum system. Make a high-vacuum source for less than $6. Eight chapters, including plastics, molds, heat and vacuum sources, tips and examples. It's easy; try it! $9.95 (plus $1.05 postage). VACUUM FORM, 272 Morganhill Dr., Lake Orion, MI 48360; or call (24 hours) 800-737-3000, ext. 2 ($1 surcharge on VISA/MC orders).

COMPUTERIZED AIRCRAFT PLOTS: technical illustrations suitable for framing. Three-views. Computer scale drafting and scanning services. Turn old prints into masterpieces! Catalogue, $1. D-TECH SYSTEMS, Rte. 2, Box 191-14, Carterville, IL 62918.

FREE BULLETIN BOARD: new electronic bulletin board for R/C modeling enthusiasts; 1200/2400 Baud support. (315) 652-5641.

CUSTOM-EMBROIDERED JACKETS, caps, patches. For 64-page color catalogue, send $2. Creative Sportswear, P.O. Box 158, Oley, PA 19547. Call (800) 444-9016.

CONTROL-LINE AND R/C kits cut on per-order basis. Send SASE to: Repli-Kit, P.O. Box 1412, Inverness, FL 32651-1412.

BALL BEARINGS for engines; high-performance, class 3/PG with polyimide, phenolic, or steel retainers. Sold in sets or individually, SASE for price list: REVMOR, P.O. Box 548, Palm City, FL 34990; (407) 283-6831 after 5.

NONE BETTER IN THE UNIVERSE! The best VHS flight-instruction tapes available anywhere! *Silicon Valley R/C Technologies* (800) 822-1500.

MAGAZINE COLLECTION for sale: 20+ years of *MAN, RCM, MB, MA, AAM, Wings, Air Power* and more! Send long SASE for list. Tony Avak, 114 Atalanta St., Lexington Park, MD 20653.

FOR SALE: all-new kits. Concept Big Fleet, $125; Bud Barkley 1/4-scale Tiger Moth (includes F/G cowl and tank), $125; Balsa USA Flybaby, $90; Balsa USA Aeronca C-3, $90; Sig Astro Hog, $50; Dave Platt 60-inch Waco-YMF-3, $50; Hobby Lobby Senior (96 inches) Telemaster, $95. Includes shipping. Mel Blair, 9 Greenway Dr., Middle Island, NY 11953; (516) 924-4661

OLD TIMERS—1967 or older—K&B Torpedo .40, series 67 rat racing engine; excellent condition; manual, original box, $75. Cox .049, excellent condition, $25. Pack of five new Williams Bros. round fuel tanks, $10. Pack of four new Williams Bros round fuel tanks, $8. Top Flite wooden props: 11x8, 11x6, 10x8, 10x6, 9x8, 9x4 and 8x8. Props $25 per dozen—one size or mixed. R. Hodge, 9 Woodland Ave., Coventry, RI 02816.

FOR SALE: original castings for no. 3 Atom. Need machining; four castings; drawings, $29.50. Joel Balsam, 4 Pickwick Hill Dr., Huntington Station, NY 11746.

SOLAR RACER KITS—10-inch, three-wheel working car kit. "Paintable" plastic body, 4-inch solar cell and all parts and instructions, $29.95 plus $3 shipping (CA only add 7.25% tax). Send check to: Speed of Light, P.O. Box 485-MA, Altadena, CA 91001, or call (818) 798-4221 for free brochure.

FOR SALE: Balsa USA 1/4-scale Sopwith Pup fuselage and tail surface; done, covered, custom-made. Also, 7-cylinder engine, 50 percent done and new Quadra and Super Hustler engines (in box). Six-channel radio. Many custom parts; over $3,000 invested. (Retired tool maker.) Will sacrifice for $1,000. Call (904) 686-4610.

COMPUTER DESIGN. Design models with CAD software. Review sampler, $11. Catalogue, $1. Complete IBM software line—graphics, business, scientific, games, Windows. State disk size. Vista-MA Software, 95106 Huaala Pl., Mililani, HI 96789.

FINANCE YOUR PROJECT by selling flying foam models. Send $2 for info and 12-inch sample boomerang. Airmate, Box 488, Bryan, OH 43506.

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R/C WORLD—ORLANDO, FL, CONDO RENTAL—2 bedroom, furnished. Available weekly or monthly. Low rates, 100 acre flying field with enclosed hangar. Swimming pool, tennis courts on site. Minutes from Disney World and Epcot Center. For information, call Micki at (800) 330-7243 or (407) 260-1252; fax (407) 331-3867; or write to: Page One Management Realty Inc., P.O. Box 4732, Winter Park, FL 32793-4732.

OLD-TIMERS, take a ride back in time to airplane modeling roots with this vintage book—*Gas Models*. A true collector's book from the early editors of *Model Airplane News*, it contains the best of modeling from the '30s and '40s, including great technical information and classic construction articles from the Golden Age period. $7.95, add $3 S&H for first item; $1.50 for each additional item. *Foreign:* (including Canada and Mexico)—*airmail*, add $7.50 for first item, $4.00 for each additional item. Payment must be in U.S. funds drawn on a U.S. bank, or by international money order. (Connecticut residents add 6% tax; Canadian residents add 7% tax.) Air Age Mail-Order Service, 251 Danbury Rd., Wilton, CT 06897.

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RUN A GASOLINE FUEL MIX in your ignition-converted ST 25000 & 3000 and O.S. BGX-1. Complete kit with new Walbro carb, $59.95. Protect your valuable airplane from ignition noise problems. New Bosch resistor spark plug cover. Works on all magneto and CDI systems, $9.95 (plus handling). Send $1 for price brochure and newsletter on many ignition parts. C&H Electronics, P.O. Box 1732, Riverton, WY 82501; (307) 857-6897.

USED ENGINES WANTED—ignition, glow, diesel. Send description and price for prompt reply. T. Crouss, 100 Smyrna St., West Springfield, MA 01089.

VIDEO VIEWS

(Continued from page 123)

flying," Patrick says, "is the precision part." The video then demonstrates, often using a split screen to show Patrick's manipulation of the sticks as we watch the plane fly, a litany of basic maneuvers including knife-edge flight, the slow roll, 4- and 8-point rolls, the outside loop, the double Immelmann, the Cuban-8, the snap roll, the avalanche and square loops. Each maneuver is flown repeatedly and with different planes. This pedagogical technique makes it a lot easier to grasp what's going on. Patrick emphasizes the importance of practice, but points out that (as my own experience verifies), after three or four flights in a day, your concentration wanders and learning stops. I would have added that that's when you start breaking airplanes.

I was puzzled for a few moments when Patrick was discussing tuned pipes and apparently telling the viewer to "tack it" each time the length is changed. I was thinking that he meant to fasten it down between tests, when I suddenly realized that he had been saying "*tach* it." An actual demonstration with a tachometer would have been a better idea.

This tape is very well done, and I can't recommend it too highly. Even if you have no interest in flying precision aerobatics, it's worth it for the smooth beauty of Patrick's flying. I look forward to seeing "Wring It Out, Vol. 3," on hot-dogging.

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